

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG DISPLAY CO., LTD.,
Petitioner,

v.

PICTIVA DISPLAYS INTERNATIONAL LTD.,
Patent Owner.

Case No. IPR2024-01093
Patent No. 8,723,164 B2

PATENT OWNER'S NOTICE OF APPEAL

Pursuant to 35 U.S.C. §§ 141, 142, and 319, and in accordance with 37 C.F.R. §§ 90.2-90.3, Patent Owner Pictiva Displays International, Ltd. (“Pictiva”) appeals to the United States Court of Appeals for the Federal Circuit from the Final Written Decision of the Patent Trial and Appeal Board (“Board”) entered on January 22, 2026 in IPR2024-01093 (Paper No. 44) (“Final Written Decision”), attached as Exhibit A, and from all underlying findings, determinations, rulings, opinions, orders, and decisions regarding the *inter partes* review (Case IPR2024-01093) of U.S. Patent No. 8,723,164 (the “’164 Patent”).

In accordance with 37 C.F.R. § 90.2(a)(3)(ii), Pictiva states that the issues on appeal include, but are not limited to: the Board’s determination that Claims 1-16 of the ’164 Patent has been shown by a preponderance of the evidence to be unpatentable; the Board’s construction of the challenged claim and application of its construction of the claim to the facts of record; the Board’s finding that the Choulis, Yong, Sugaira and Thompson references qualifies as a proper basis for an IPR proceeding and as a prior art reference to Claims 1-166 of the ’164 patent; the Board’s procedural rulings; the adequacy of the Board’s consideration of the expert testimony, prior art, and other evidence in the record, including, but not limited to, evidence and testimony from related district court proceedings between Petitioner and Patent Owner; the Board’s factual findings, conclusions of law, or other determinations supporting or related to those issues (such as motivation to combine

or reasonable expectation of success); the Board's compliance with the Administrative Procedure Act, including whether the Final Written Decision and denial of Director Review are arbitrary, capricious, an abuse of discretion, not in accordance with law, or in excess of the Board's jurisdiction, and any procedural irregularities associated with the review proceeding; as well as all other issues decided adversely to Pictiva in any orders, decisions, rulings, and opinions.

This Notice of Appeal is being e-filed with the Clerk's Office for the United States Court of Appeals for the Federal Circuit, along with payment of the required docketing fees. In addition, a copy of this Notice of Appeal is being filed simultaneously with the Patent Trial and Appeal Board and filed by e-mail to the Director of the United States Patent and Trademark Office at efileSO@uspto.gov.

Dated: March 26, 2026

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. § 42.6, that on March 26, 2026, a complete copy of the foregoing document, **PATENT OWNER'S NOTICE OF APPEAL** was served by ELECTRONIC MAIL, as agreed to by the parties, upon the following:

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I also certify that in addition to being filed electronically with the Board, a copy of this Notice of Appeal was deposited with Priority Mail Express on March 26, 2026, for delivery to the Director of the United States Patent and Trademark Office at the following address:

Director of the United States Patent and Trademark Office
c/o Office of the General Counsel
Mail Stop 8
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CERTIFICATE OF FILING

I further certify that a copy of the foregoing Notice of Appeal is being filed via CM/ECF on March 26, 2026 with the United States Court of Appeals for the Federal Circuit.

/Pia S. Kamath/
Pia S. Kamath

EXHIBIT A

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG DISPLAY CO., LTD.,
Petitioner,

v.

PICTIVA DISPLAYS INTERNATIONAL LTD.,
Patent Owner.

IPR2024-01093
Patent 8,723,164 B2

Before GRACE KARAFFA OBERMANN, GARTH D. BAER,
and JASON M. REPKO, *Administrative Patent Judges*.

OBERMANN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Petitioner¹ challenges claims 1–16 of U.S. Patent 8,723,164 B2 (Ex. 1001, “the ’164 patent”). Paper 1 (“Pet.”). Patent Owner² opposes the challenges. We instituted an *inter partes* review based on all challenges asserted in the Petition. Paper 11 (“Inst. Dec.”).

We have jurisdiction under 35 U.S.C. § 6. Pursuant to 35 U.S.C. § 318, we enter this Final Written Decision, which is based on arguments and evidence presented in the Petition, Patent Owner’s Response (Paper 21, “Resp.”), Petitioner’s Reply (Paper 29, “Reply”), and Patent Owner’s Sur-reply (Paper 35, “Sur-reply”). In reaching our decision, we also take account of the final oral arguments heard on October 24, 2025. Paper 43.

For reasons that follow, we determine that Petitioner proves by a preponderance of the evidence that claims 1–16 of the ’164 patent are unpatentable based on the challenges asserted in the Petition. *See* Pet. 6 (summary of the challenge).

II. BACKGROUND

A. *Related Proceedings*

The parties identify *Pictiva Displays Int’l Ltd. v. Samsung Electronics Co., Ltd.*, No. 2:23–cv–00495 (E.D. Tex.) (“the District Court action”) as a related proceeding. Pet. 5; Paper 3, 1.

¹ Petitioner identifies Samsung Display Co., Ltd., Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. as real parties-in-interest. Pet. 5.

² Patent Owner identifies Pictiva Displays International Ltd., “a subsidiary of Key Patent Innovations Limited,” as “the owner” of the ’164 patent. Paper 3, 1. Patent Owner further states that Key Patent Innovations Limited “is a wholly-owned subsidiary of New PP Licensing, LLC.” *Id.*

B. The '164 Patent (Ex. 1001)

The '164 patent relates to “an electronic device and a method for the production of an electronic device.” Ex. 1001, 1:15–16. The '164 patent explains that electronic devices, including organic light-emitting diodes (“OLEDs”), comprise several functional organic layers, such as an emission layer having a matrix material doped with emitter molecules. *Id.* at 1:20–23. Excitons are formed in the emission layer due to a recombination of electrons and holes, which causes the emission of light. *Id.* at 1:23–25.

According to the '164 patent, “the ratio between electrons and ‘holes’ which are transported in the emission layer is decisive” for obtaining a highly-efficient electronic device and “[a] nonbalanced ratio between hole and electron transport results in a low radiation efficiency of the device.” *Id.* at 1:28–29. In view of this, the '164 patent states that an object of the invention “is to provide an electronic device with an improved charge carrier transport and an improved charge carrier balance in the organic layers and thus an increased efficiency.” *Id.* at 1:33–36.

The '164 patent describes molecular orbitals materials, including the Lowest Unoccupied Molecular Orbital (“LUMO”) and Highest Occupied Molecular Orbital (“HOMO”). *Id.* at 1:46–55. The '164 patent explains:

According to the molecular orbital theory, in one molecule there are several molecular orbitals with different energy levels, which can be occupied by the existing electrons. These molecular orbitals are occupied according to increasing energy level. The LUMO is the energetically lowest molecular orbital which is no longer occupied with an electron. The HOMO is the energetically highest molecular orbital which is still occupied with an electron.

Id. at 1:60–67.

The '164 patent further describes an electronic device that includes a substrate, a first electrode, a second electrode, and at least one organic functional layer having a first matrix material, a second matrix material, and a third matrix material. *Id.* at 1:38–48. The '164 patent explains that holes are created by removing an electron from the HOMO of a material, this is more difficult with an energetically low HOMO than one with a high energy, and that because the second matrix material has a higher HOMO than the third matrix material, the second matrix material is more suitable as a hole transport material. *Id.* at 2:46–52.

In addition, the '164 patent explains, creation of electrons is favored in LUMOs that are energetically lower, therefore, the third matrix material has a lower LUMO than the second matrix material. *Id.* at 2:52–57. The '164 patent also states:

The first matrix material is selected thereby so that it has a large band gap that is, the difference between HOMO and LUMO, for example, so that its HOMO is energetically below the HOMO of the other two matrix materials, and its LUMO is energetically above the LUMO of the other two matrix materials.

Id. at 2:4–9. We reproduce below Figure 2, which depicts that relationship.

Fig. 2

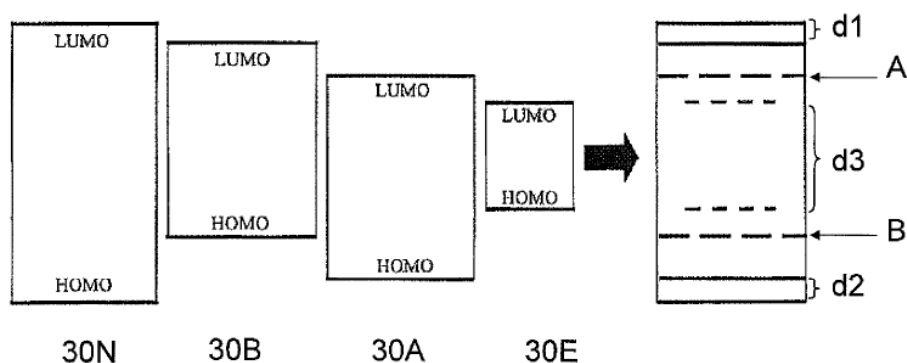


Figure 2 illustrates a schematic side view of various matrix materials. *Id.* at 5:63–64. The '164 patent describes how first matrix material 30N has a HOMO that is energetically lower than those of second matrix material 30B and third matrix material 30A, where a LUMO is energetically higher than those of second matrix material 30B and third matrix material 30A. *Id.* at 6:19–26. Second matrix material 30B has a LUMO energetically higher than the LUMO of third matrix material 30A and a HOMO energetically higher than the HOMO of third matrix material 30A. *Id.* at 6:26–30.

The organic functional layer may be doped with an emitter material, which may have a lower LUMO and a higher HOMO than the three matrix materials. *Id.* at 3:61–63, 4:44–49. For example, emitter material 30E may have a LUMO and HOMO between those of matrix materials 30N, 30B, 30A. *Id.* at 6:34–37.

C. Challenged Claims

Claims 1–16 of the '164 patent are at issue in this proceeding. Pet. 1. Claim 1, reproduced below, is illustrative of the claimed subject matter.

1. An electronic device, comprising:

a substrate;

a first electrode;

at least one organic functional layer; and

a second electrode, wherein the at least one organic functional layer is located between the first electrode and the second electrode, and wherein the at least one organic functional layer has at least a first matrix material, a second matrix material, and a third matrix material, and the third matrix material has a Lowest Unoccupied Molecular Orbital (LUMO), which is energetically lower than the LUMO of the second matrix material and the LUMO of the first matrix material, and wherein the second

matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material,

wherein the organic functional layer is an emission layer and is doped with at least one emitter material.

Ex. 1001, 9:4–22.

D. Asserted Challenges to Patentability

The Petition sets forth the following grounds of patentability.³

Claim(s) Challenged	35 U.S.C. §⁴	Reference(s)/Basis
1–8, 10–16	102(b)	Choulis ⁵
1–8, 10–16	103(a)	Choulis ⁶
9	103(a)	Choulis, Yong ⁷
1, 3, 5–8, 10–13	102(b)	Sugiura ⁸
1, 3, 5–8, 10–13	103(a)	Sugiura
15–16	102(b)	Thompson ⁹
15–16	103(a)	Thompson

Pet. 6. Petitioner advances the Declaration of Dr. Russel J. Holmes (Ex. 1003) and the Reply Declaration of Dr. Holmes (Ex. 1044). Patent Owner advances the Declaration of Dr. Marc Sims (Ex. 2019).

³ Petitioner groups some grounds together in its summary of the challenge. *See* Pet. 6. We identify each ground individually.

⁴ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. § 103 effective March 16, 2013. Because the ’164 patent’s priority date is before the AIA’s amendments to Sections 102 and 103, this decision refers to pre-AIA statutory provisions. Neither party indicates the result would change under the AIA version.

⁵ US 2007/0069636 A1, published March 29, 2007 (Ex. 1004).

⁶ US 2007/0069636 A1, published March 29, 2007 (Ex. 1004).

⁷ CN 1582073 A, published February 16, 2005 (Ex. 1008). We refer to the certified English translation of Yong (Ex. 1009).

⁸ JP 2001-110568 A, published April 20, 2001 (Ex. 1005). We refer to the certified English translation of Sugiura (Ex. 1006).

⁹ US 2004/0155238 A1, published August 12, 2004 (Ex. 1007).

III. ANALYSIS

A. Level of Ordinary Skill in the Art

The level of ordinary skill in the art at the time of the invention is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 1324 (Fed. Cir. 1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)).

Petitioner contends:

A person of ordinary skill in the art (“POSITA”) at the time of the alleged invention of the ’164 patent would have had a Bachelor’s degree in chemistry, physics, or a comparable field of study, and at least three years of research or industrial experience with organic optoelectronic light-emitting devices. An individual with additional education could have less research or industrial experience and vice versa.

Pet. 12. Patent Owner repeatedly refers to “a POSITA” without addressing the definition of that term or contesting Petitioner’s proposed definition. *See* Resp. 1, 2 n.1, 3, 8, 9, 15–21, 23, 26, 29, 32–33, 35, 37, 38, 40, 41, 44–49, 51–57, 61, 62 (bare references to “a POSITA”).

Neither party indicates that the ultimate result on patentability would change depending on the definition selected. We adopt Petitioner’s proposed definition, which is not contested, because it is consistent with the disclosures of the asserted prior art. *See* Ex. 1004, (code 57); Ex. 1006, code (57); Ex. 1008, code (57); Ex. 1009, code (57) (abstracts of the references asserted in the patentability challenges).

B. Claim Construction

In an *inter partes* review, the Board construes the terms of a patent claim “in accordance with the ordinary and customary meaning of such

claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). Under that standard, claim terms generally are given their plain and ordinary meaning as would have been understood by the ordinarily skilled artisan at the time of the invention and within the context of the entire patent disclosure. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

We construe claim terms only as relevant to the parties’ contentions and only to the extent necessary to resolve the issues in dispute. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). Neither party indicates that an express construction for any claim term is necessary to this Decision. Pet. 15; Resp. 8.

Nevertheless, Patent Owner raises a dispute about the scope of the claim term “matrix material.” Ex. 1001, 9:11–13. Specifically, Patent Owner argues that this claim term excludes “embedded materials, such as dopants and dispersed agglomerations.” Sur-reply 9; *see* Resp. 8 (similar argument). Patent Owner here reasserts a twice-rejected argument that “for something to be a matrix, it should have a continuous character, not be discontinuous,” therefore, “discontinuous dopants and dispersed agglomerations are not part of the matrix.” *Id.* (quoting Ex. 2020, 273:3–5). We first rejected that argument for sound reasons based on the preliminary record. Inst. Dec. 12–30. The district court thereafter rejected the same argument after full briefing on claim construction and a *Markman* hearing. Ex. 2032, 1, 32–35, 50.

We determine again that Patent Owner’s argument is unpersuasive because no information raised during the trial phase of this review changes the calculus: First and foremost, the plain terms of claim 1 include no

language from which we reasonably can impose limits on the phrase “matrix material” as urged by Patent Owner. In addition, the specification includes no special definition of that phrase that supports importing Patent Owner’s proposed narrowing limitation into the claim. Furthermore, we are directed to no disclaimer of claim scope during patent prosecution that would support Patent Owner’s twice-rejected argument that the phrase “matrix material” in claim 1 excludes embedded dopants and dispersed agglomerations. And the extrinsic evidence advanced by Patent Owner during this review is ineffective to override the clear interpretation of “matrix material” that is established by the intrinsic evidence. Reply 1–7.¹⁰

Claim 1 includes no words that narrow the term “matrix material” to exclude materials that can serve dopants. Ex. 1001, 9:4–22. In reaching that conclusion, we take full account of all the words that appear in claim 1, including the words that specify an “organic functional layer” that has at least three “matrix” materials and one doped “emitter” material. Ex. 1001, 9:4–22. Patent Owner improperly reads that language to exclude from the scope of a “matrix” material any moiety that is described as a “dopant.” Sur-reply 3 (submitting “that the prior art expressly discloses certain materials as being used as dopants” where “the ’164 patent *defines at least by implication* matrix materials to exclude dopants by consistently contrasting a ‘matrix material’ with a dopant, such as an emitter.”) (emphasis in original). But aside from “reciting relationships between the LUMOs and HOMOs of the matrix material,” the plain words of claim 1 imposes no “particular

¹⁰ For the sake of brevity, we adopt Petitioner’s assessment of the evidence as our own and determine that the evidence fully supports our findings on the scope of the term “matrix material.” Our further discussion of the evidence is for emphasis only.

composition or any particular amount for any of the three matrix materials.”
Reply 1–2; Ex. 1044 ¶ 3.

The specification of the ’164 patent contains no definitional language that supports importing such a limitation into claim 1. To the contrary, express disclosures in the specification make plain that a material described as a dopant nevertheless may serve as a matrix material if its HUMO and LUMO levels satisfy the relationship set forth in the claim. Ex. 1001, 8:56–65. In particular, the specification indicates that BCP (that is, 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline) may serve as a dopant or, alternatively, may serve (based on its HUMO and LUMO levels) as a matrix material. Reply 3 (citing Ex. 1001, 8:56–65); Ex. 1044 ¶ 6.

To be clear, the specification describes the same material (BCP) as suitable to serve as a matrix material or a dopant. *Compare* Ex. 1001, 7:53–55, 8:10 (identifying BCP as a suitable third matrix material in the organic functional layer), *with id.* at 8:56–65 (identifying BCP as a suitable emitter material for doping into the organic functional layer). Patent Owner’s witness, Dr. Sims, fails to square those intrinsic disclosures with Patent Owner’s view that a material identified as a “dopant” in the prior art is disqualified as a matrix material within the scope of claim 1, even if the material meets the HUMO and LUMO levels required by claim 1. Reply 3 (citing Ex. 1043, 39:16–40:1, 43:10–14, 44:2–10; Ex. 2020, 23:5–26:7).

On this record, intrinsic disclosures within the four corners of the specification speak strongly against Patent Owner’s view that the inventors, acting as their own lexicographers, “at least by implication” defined “matrix material” in the specification to exclude any moiety described in the prior art as a “dopant.” Sur-reply 3 (emphasis omitted). We decline Patent Owner’s

invitation to read into claim 1 a narrowing limitation “by implication” from the specification. Sur-reply 3 (emphasis omitted). Doing so would violate long-settled rules of claim construction, which counsel against importing a limitation into a claim from the written description of an invention, absent clear proof that the inventors, acting as their own lexicographers, set forth that limitation in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The inventors plainly did not do so here. *See* Ex. 1001, 7:53–55, 8:10, 8:56–65 (describing the same material; namely, BCP, as both a suitable matrix material and a suitable dopant or emitter material, and making clear that suitable matrix materials are defined solely in terms of their HOMO and LUMO levels).

In a nutshell, for reasons well-stated by Petitioner (Reply 1–7), we reject Patent Owner’s interpretation of “matrix material” as excluding “embedded” materials “such as dopants or dispersed agglomerations” (Sur-reply 1). Instead, we adopt as our own the district court’s well-reasoned findings, entered in the co-pending litigation, as to the correct construction of “matrix material”: (1) Nothing about the term “matrix material” imports a requirement for “a material that forms a continuous phase” (Ex. 1030, 32–35); and (2) the first, second, and third matrix materials of claim 1 “are different materials and are part of the same matrix.” *Id.* at 50. In the analysis that follows, therefore, we apply that construction of “matrix material.” Our analysis below includes additional discussion of the scope of the term “matrix material” but only to the extent necessary to resolve Petitioner’s patentability challenges.

C. Ground 1: Anticipation of Claims 1–8 and 10–16 by Choulis

We next turn to whether Petitioner shows by a preponderance of the evidence that Choulis anticipates claims 1–8 and 10–16. *Compare* Pet. 19–48; Reply 7–17, with Resp. 26–47; Sur-reply 12–16.

(a) Overview of Choulis

Choulis “relates to phosphorescent organic luminescent devices” and optoelectronic devices, such as OLEDs. Ex. 1004 ¶¶ 2, 14. Choulis depicts a single OLED pixel in Figure 2, which is reproduced below.

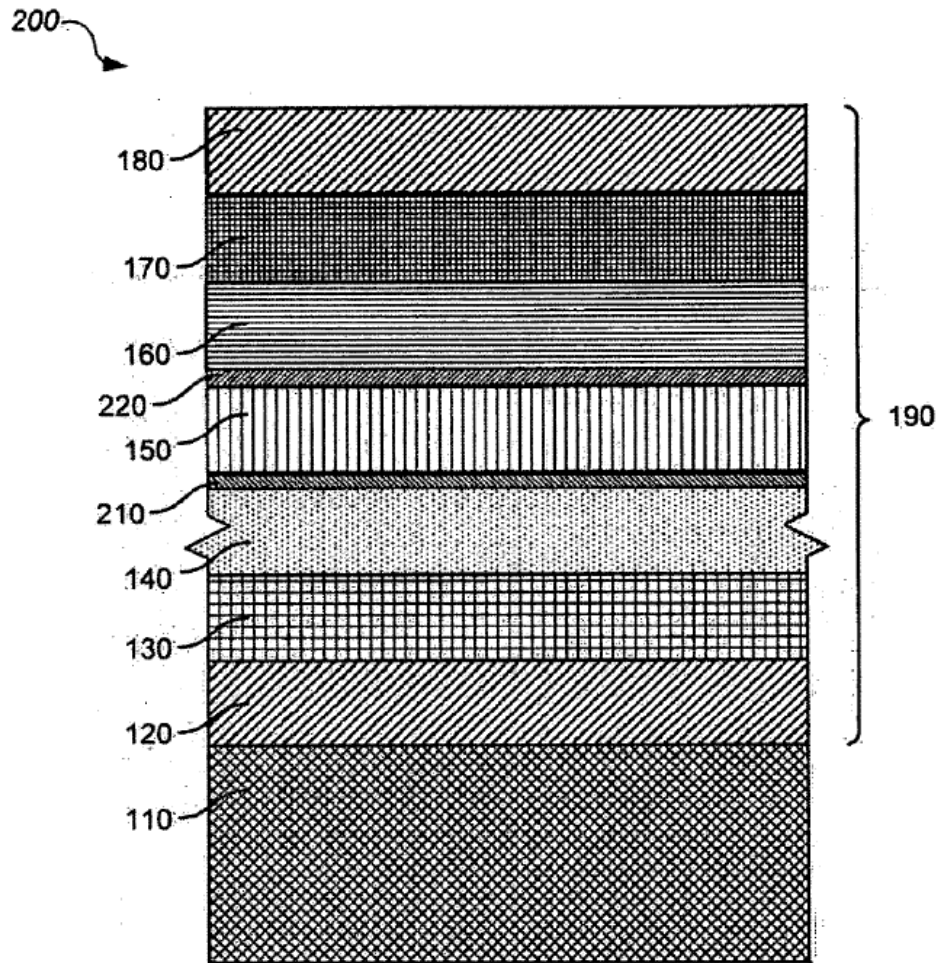


FIG. 2

Figure 2 illustrates OLED 200, which includes substrate 110, anode 120, hole injection layer 130, hole transport layer 140, light emitting layer 150,

electron transport layer 160, electron injection layer 170, and cathode 180.

Id. ¶¶ 3, 21. Choulis explains that OLED 200 may further include matching layers 210, 220 that may be positioned adjacent to light emitting layer 150.

Id. ¶ 22.

Choulis further states that organic moieties “can be mixed in with the light emitting layer.” *Id.* ¶ 30. Such an arrangement is illustrated in Figure 4, which is reproduced below.

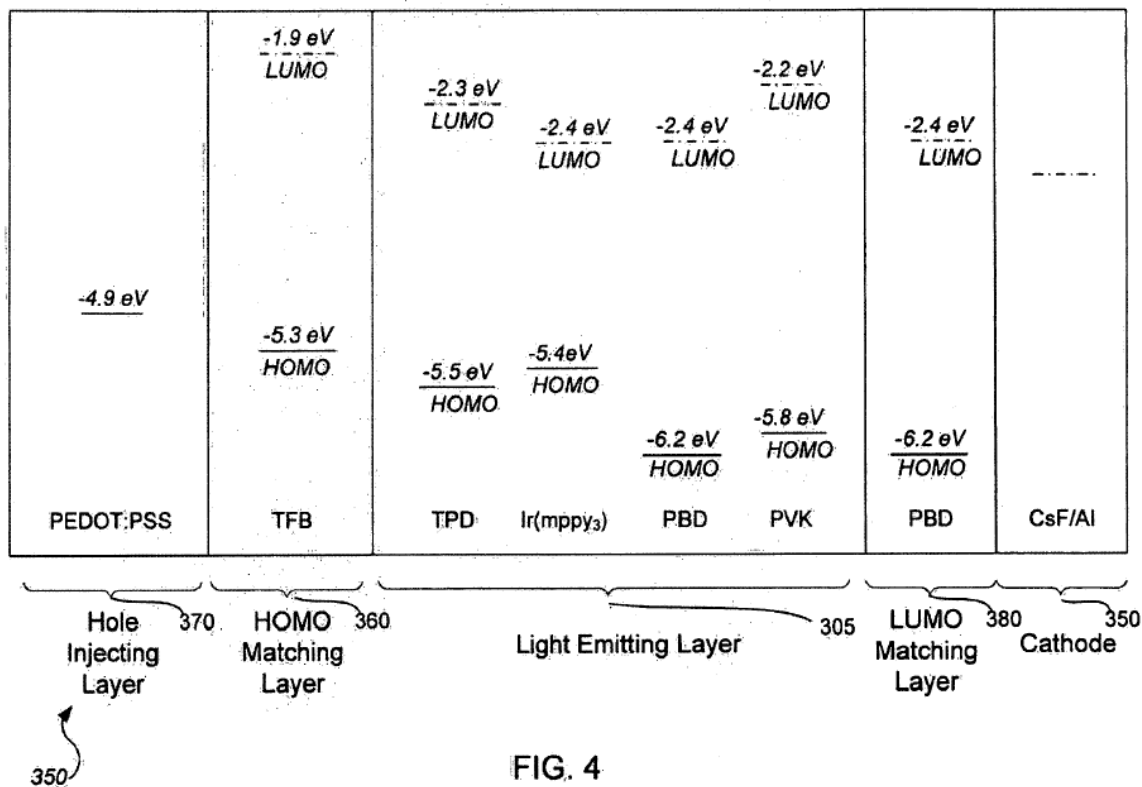


Figure 4 illustrates Choulis’s arrangement, in which “light emitting layer 305 includes a host material 310, poly(9-Vinylcarbazole) (PVK), a light emitting material 320, (Ir(mppy)₃), a first organic moiety 330, triphenyldiamine (TPD) and a second organic moiety 335, PBD,” that is, 2-(4-biphenyl-5(4-tert-butyl-phenyl)-1,3,4-oxadiazole. *Id.*; Ex. 1004 ¶ 30.

(b) Overview of Petitioner's Evidence as to Claim 1

Petitioner argues that Choulis describes optoelectronics devices and forming OLED devices. Pet. 20 (citing Ex. 1004, code (57), ¶¶ 2, 14; Ex. 1003 ¶¶ 72–74). Petitioner identifies where Choulis teaches a substrate, a first electrode, at least one organic functional layer, and a second electrode, and, in addition, where the organic functional layer is located between the first and second electrode, citing Choulis's substrate 110, anode 120, light emitting layer 150, and cathode 180 shown in Figure 2 above. *Id.* at 21–24 (citing Ex. 1004 ¶¶ 3, 14, 24, Fig. 2; Ex. 1003 ¶¶ 76–84).

Petitioner explains how Choulis teaches first, second, and third matrix materials having the LUMO and HOMO relationships required by claim 1, citing the materials described by Choulis for light emitting layer 305 (PVK, TPD, and PBD) and their respective HOMO and LUMO, as illustrated in Choulis' Figure 4, reproduced above. *Id.* at 24–27 (citing Ex. 1004 ¶ 30, Fig. 4; Ex. 1003 ¶¶ 85–94). Petitioner directs us to additional evidence that Choulis describes its light emitting layer as an organic functional layer that may be doped with an emitter material, citing Ir(mppy)₃ in Figure 4. *Id.* at 27–28 (citing Ex. 1004 ¶¶ 14, 30, 43, Fig. 4; Ex. 1003 ¶¶ 95–96).

(c) Analysis: Anticipation of Claim 1 by Choulis

Choulis describes optoelectronics devices and forming OLED devices and Choulis's Figure 2 depicts substrate 110, anode 120, light emitting layer 150, and cathode 180, where light emitting layer 150 is located between anode 120 and cathode 180. Ex. 1004 ¶¶ 2, 3, 14, 3, 14, 24, Fig. 2. Choulis further describes an arrangement in which a light emitting material includes PVK, TPD, and PBD, which function as first, second, and third matrix materials having the HOMO and LUMO relationships claim 1 recites. *Id.*

¶ 30, Fig. 4. In addition, Choulis describes light emitting materials as emitting light via fluorescence or phosphorescence and discloses including an emitter material in its light emitting layer, such as Ir(mppy)₃. *Id.* ¶¶ 14, 30, 43, Fig. 4.

Patent Owner does not meaningfully dispute those facts. *See* Resp. 26–33. Petitioner provides reasons why those facts establish that Choulis anticipates claim 1 by mapping each feature of claim 1 to disclosures in Choulis. Pet. 19–28. It is worth emphasizing here that Patent Owner “does not dispute that PVK is a host material, PVD is a hole transporting material, and PBD is an electron transport material, all residing in the same light emitting layer” as illustrated in Choulis’s Figure 4. Reply 8. Nor does Patent Owner “dispute that PVK, TPD, and PBD have the HOMO/LUMO levels required by claim 1.” *Id.*

Patent Owner opposes this challenge based on three rationales, which we address in turn below:

i. The term “matrix material” in claim 1 excludes dopants or dispersed agglomerations (Resp. 26–30);

ii. Choulis “does not *unambiguously* disclose that *its* TPD and PBD materials are in fact host or matrix materials,” therefore, to prevail Petitioner must establish that the reference “inherently” teaches that those substances represent “host or matrix materials” (*id.* at 30 (Patent Owner’s emphases)); and

iii. TPD cannot qualify as a matrix material because its concentration in the Choulis’s organic functional layer is 9 wt% (*id.* at 31).

i. Dopants or Dispersed Agglomerations as Matrix Materials

Patent Owner first argues that the claim term “matrix material” excludes dopants or dispersed agglomerations and, on that basis, contends

that Choulis's TPD and PBD do not qualify as "matrix materials" because Choulis describes those materials as dopants. Resp. 26–30.

Our analysis above, regarding the correct scope of the term "matrix material," disposes of this argument. For reasons explained above, we reject Patent Owner's proposal that the term "matrix material," *ipso facto*, excludes materials described by the prior art as dopants. Accordingly, we agree with Petitioner that "Choulis's description of PVK as a host and TPD and PBD as organic moieties that can be co-doped does not preclude TPD and PBD from being considered matrix materials." Reply 8.

Stated somewhat differently, even if Choulis does not describe TPD and PBD as "host or matrix materials" (Resp. 30), that, standing alone, does not detract from Petitioner's evidence that Choulis teaches that its TPD and PBD, in the organic functional layer depicted in Choulis's Figure 4, satisfy every requirement of a "matrix" material as specified in claim 1, including the HUMO and LOMO relationships required by claim 1 (Pet. 19–28).

In reaching that conclusion, we take note of the further requirement in claim 1 that the organic functional layer must be "doped with at least one emitter material." Ex. 1001, 9:22. That further requirement, however, does not support Patent Owner's view that neither TPD nor PBD, as disclosed in Choulis, can qualify as "matrix" materials within the scope of claim 1. *Id.* at 9:11–13. The '164 patent explicitly characterizes matrix materials to include hole transport materials and electron transport materials. Ex. 1001, 5:34–37, claims 5, 6. The intrinsic record makes plain that TPD is a hole transport material, PBD is an electron transport material, and Choulis contemplates that such materials may serve as matrix materials. *Compare* Pet. 24–25, 33–34 (setting forth these well-supported factual propositions), *with* Resp. 26–

29 (declining to effectively contest those factual propositions). To the extent any doubt remains, the specification of the '165 patent expressly identifies “TPD” as a suitable “first, second, or third matrix” material. Ex. 1001, 8:38–40, 8:50.

Importantly, Petitioner identifies a different substance in Choulis as meeting the required “emitter material” that, according to claim 1, must be doped into the organic functional layer. In particular, as Petitioner points out, “Choulis discloses that its light emitting layer is doped with, e.g., Ir(mppy)₃ or rubrene (i.e., ‘emitter material’).” Pet. 28 (citing Ex. 1003 ¶ 95). Petitioner maps three distinct moieties (namely, PVK, TPD, and PBD) in Choulis to the specified first, second, and third matrix materials of claim 1 and other distinct moieties (namely, Ir(mppy)₃ or rubrene) to the additional limitation of claim 1 that specifies “at least one emitter material.” *Id.* at 24–25. We find significant that this is not a situation in which a petitioner inappropriately maps a single structure in the prior art (for example, TPD) to two different claimed structures (“matrix material” and “emitter material”).

On this record, Petitioner’s argument that Choulis’s TPD and PBD do not qualify as “matrix materials,” because Choulis describes those materials as dopants, does not undercut Petitioner’s evidence that Choulis anticipates claim 1. Resp. 26–30.

ii. Inherency

Somewhat relatedly, Patent Owner argues that, because Choulis “does not *unambiguously* disclose that *its* TPD and PBD materials are in fact host or matrix materials,” Petitioner was required to come forward with evidence that those substances are “inherently host or matrix materials” in Choulis’s

device. Resp. 30 (Patent Owner’s emphases). We disagree. As Petitioner persuasively points out:

Choulis discloses that PVK, TPD, and PBD correspond to the claimed first, second, and third matrix materials, respectively. Pet. 24–25; Inst. Dec. 32–33; Ex. 1004 ¶ 16. [Patent Owner] does not dispute that PVK is a host material, TDP is a hole transporting material, and PBD is an electron transport material, all residing in the same light emitting layer. Pet. 24–25, 33–34; Resp. 26–29. [Patent Owner] also does not dispute that PVK, TPD, and PBD have HOMO/LUMO levels required by claim 1. The ’164 patent explicitly characterizes a hole transport material and an electron transport material, such as those disclosed by Choulis, as matrix materials. Ex. 1001, 5:34–37, claims 5, 6. Elsewhere, [Patent Owner] even equates hole and electron transport materials to the second and third matrix materials. Resp. 38 (“hole and electron transport materials (*i.e.*, second and third matrix materials)”).

Reply 7–8 (citations altered). Given those undisputed facts, we disagree with Patent Owner that Petitioner was required to show by inherency that Choulis anticipates the “matrix” materials specified in claim 1. Resp. 30.

To the contrary, for reasons well-stated by Petitioner, we find that Choulis discloses an organic functional layer in which PVK, TDP, and PBD satisfy every requirement of the specified “matrix” materials, most notably the HOMO/LUMO levels specified in claim 1. Reply 1–7; *see* Pet. 24–25, 33–34 (Petitioner’s well-supported arguments on point) (citing Ex. 1003 ¶¶ 85–88, 107–108 (Dr. Holmes’ declaration testimony); Ex. 1004, Fig. 4, ¶¶ 30, 46 (Choulis)).

iii. TPD Concentration of 9 wt%

Patent Owner argues that TPD cannot qualify as a matrix material because its concentration in Choulis’s organic functional layer is 9 wt%. Resp. 31. Patent Owner here asserts an old argument from a new

perspective; namely, that TPD in a concentration of 9 wt% is a dopant that cannot qualify as “a matrix or host” material within the scope of claim 1. *Id.*

Our reasoning above, presented in the context of claim construction, applies with equal force here. For reasons explained above, we reject Patent Owner’s view Choulis’s TPD, when present in the organic functional layer in a concentration of 9 wt%, cannot qualify as a matrix material because TPD is a dopant. *Id.* at 30–32.

We agree with Petitioner that claim 1 “does not require any particular composition or any particular amount for any of the three matrix materials.” Inst. Dec. 24 (citing Ex. 1001, 9:4–22). We reject Patent Owner’s attempt to import into claim 1 a limitation that would exclude as a matrix material a moiety (such as TPK) that is present in a particular concentration (namely, 9 wt %), where claim 1 includes no language that limits the material composition or concentration of any matrix material. Ex. 1001, 9:4–22.

In the alternative, we agree with Petitioner that Patent Owner attempts to narrow the disclosure of Choulis to an embodiment “where TPD is noted as having roughly 9% concentration within” a mixture. Reply 9. We reject that attempt because no showing is made that “Choulis’s teaching regarding TPD limited to the “singular exemplary embodiment” advanced by Patent Owner. Reply 9; Ex. 1004 ¶ 54; Ex. 1044 ¶ 19. Patent Owner, in that regard, relies on a paragraph plainly denoted as an “EXAMPLE.” Ex. 1004 ¶ 54 (immediately preceding heading). We find, on this record, that “Choulis does not restrict its teachings to this concentration or to this specific exemplary embodiment.” Ex. 1044 ¶ 19.

Petitioner further identifies a separate problem underlying Patent Owner’s view that Choulis’s TPD cannot qualify as a matrix material within

the scope of claim 1 because Choulis describes an exemplary embodiment in which that moiety is used in concentrations as low as 9 wt %. Resp. 31; Reply 9. The specification of the '164 patent expressly identifies “TPD” as a moiety that is suitable for use as the “first, second, or third matrix” material. Ex. 1001, 8:40, 8:50. Patent Owner unpersuasively suggests that, notwithstanding that circumstance, at some unstated but relatively low concentration, TPD is not suitable as a matrix material. Resp. 31. Critically lacking, however, is any disclosure in the specification that would justify importing such a narrowing limitation into claim 1. *Id.* (arguing that Petitioner must prove that TPD, when present in a concentration of 9 wt%, “is capable of being a matrix or host” material, or “that it inherently is”).

We find significant, in that regard, that Patent Owner “does not indicate ‘the threshold at which a material would have been recognized as, and considered, a matrix material’ in view of the written description of the invention or how an ordinarily skilled artisan would have determined “such a threshold.” Reply 9. As we stated in our Institution Decision, accepting Patent Owner’s view that claim 1 implicitly limits the weight percentage concentration of the suitable matrix materials would insert uncertainty into the scope of claim 1. Inst. Dec. 25. Patent Owner’s proposed interpretation of claim 1 — as excluding TPD when present in an amount of 9 wt% in an organic functional layer — leaves unanswered “whether one of ordinary skill in the art would be able to ascertain the scope of a ‘matrix material,’ as recited in claim 1, with reasonable certainty if we were to construe ‘matrix material’ as suggested by Patent Owner.” *Id.*

Patent Owner’s proposed interpretation, thereby, introduces into claim 1 concerns of indefiniteness. We decline to adopt Patent Owner’s

proposed interpretation because doing so would run afoul of the axiom that “claims are generally construed so as to sustain their validity, if possible.” *Whittaker Corp. v. UNR Indus., Inc.*, 911 F.2d 709, 712 (Fed. Cir. 1990); *see* Reply 9 (Petitioner’s related, persuasive arguments); *see also* Inst. Dec. 25 (discussing the indefiniteness issue). Patent Owner does not address that point head-on, but instead falls back on its now thrice rejected argument that, “when a prior art reference explicitly discloses using a chemical composition as a dopant,” that chemical composition, *ipso facto*, cannot qualify as a “matrix material” within the scope of claim 1. Sur-reply 14.

For the above reasons, including our determination that Patent Owner’s argument is unsupported by the plain language of the claims and the written description of the invention in the ’164 patent, we disagree with Patent Owner’s view that TPD is not a matrix material in Choulis’s organic functional layer because its concentration is 9 wt%. Resp. 31.

(d) Conclusion: Anticipation of Claim 1 by Choulis

On this record, we determine that Petitioner establishes by a preponderance of the evidence that Choulis anticipates claim 1.

(e) Analysis: Anticipation of Claims 2–8 and 10–16 by Choulis

Petitioner maps disclosures in Choulis to the additional limitations of claims 2–8 and 10–16. Pet. 29–48. Patent Owner opposes Petitioner’s evidence of unpatentability. Resp. 34–48. Adopting the convention set forth in the parties’ briefs, in the next four sections of our analysis, we organize our analysis into four separate sections, relating to four separate claim groups, which together resolve the parties’ dispute about whether Choulis anticipates claims 2–8 and 10–16. *Id.*; Reply 9–17; Sur-reply 14–16.

i. Claims 2, 4, 15, and 16

Claim 2 and 15 require a first matrix material having “a LUMO which is energetically higher than the LUMO of the second matrix material and the LUMO of the third matrix material, and a HOMO which is energetically lower than the HOMO of the second matrix material and the HOMO of the third matrix material.” Ex. 1001, 9:23–28, 10:35–40.

Claims 4 and 16, by contrast, require that “the first matrix material has a charge carrier mobility which is lower than the charge carrier mobilities of the second and third matrix materials.” *Id.* at 9:34–37, 10:58–60.

Petitioner argues that Choulis teaches an embodiment in which its light emitting layer (that is, an organic functional layer) includes polymethyl methacrylate (PMMA). Pet. 29–31, 33, 43–48. Petitioner relies on Choulis’s explicit teaching of a “light emitting layer” that “can include PVK or, alternatively, PMMA.” Reply 10 (citing Ex. 1004 ¶ 44; Ex. 1044 ¶ 22).

Patent Owner, for its part, opposes Petitioner’s evidence based on three arguments; namely, that (1) Choulis does not link the use of PMMA to the light emitting layer that is depicted in Figure 4 (Resp. 34–35); (2) a background reference, known as Yang,¹¹ undercuts the explicit teaching in Choulis that is cited by Petitioner in support of this anticipation challenge (*id.* at 36–40); and (3) as to claims 4 and 16, Petitioner does not establish that PMMA has a lower charge carrier mobility than PBD and TPD (*id.* at 40–41).

We address those three arguments in turn below.

¹¹ X.H. Yang and D. Neher, *Polymer electrophosphorescence devices with high power conversion efficiencies*, 84 Appl. Phys. Lett. 2476–2478 (2004) (Ex. 1017).

(1) PMMA and Choulis's Figure 4 Embodiment

First, Patent Owner argues that Petitioner “has not shown that Choulis discloses all elements of these claims ‘arranged or combined in the same way as in the claim[s].’” *Id.* at 34 (quoting *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369–72 (Fed. Cir. 2008)). In Patent Owner’s view, Choulis’s Figure 4 is confined to an embodiment in which PVK is the first host material: “Nothing in” Choulis’s description of using PMMA as the first host material, according to Patent Owner, “links PMMA to the device in the Figure 4 embodiment,” therefore, Choulis does not anticipate an embodiment in which PMMA replaces PVK as the first host material in Figure 4. Resp. 35.

For reasons stated by Petitioner, however, we determine that argument is not persuasive. Reply 10; Ex. 1003 ¶ 97; Ex. 1004 ¶ 44; Ex. 1044 ¶ 22. Simply put, we agree with Petitioner that Choulis anticipates a “light emitting layer” in which the first host material is PMMA, instead of PVK, “as described above” in Figure 4. Ex. 1004 ¶ 44.

To be clear, Patent Owner focuses on the appearance of the phrase “as described above” in the relevant disclosure from Choulis, but advances an unpersuasively narrow interpretation of that phrase:

The light emitting layer can include a host material. The hole material can be PVK, *as described above*, which is a non-conjugated polymer having mostly hole transporting properties. ... In some embodiments, the light emitting layer includes materials that are insulated matrices, that is, the host does not have transport properties, such as polycarbonate (PC), polymethyl methacrylate (PMMA) or polystyrene sulphonate (PSS).

Resp. 35 (Board’s emphasis) (quoting Ex. 1004 ¶ 44); *see* Pet. 29 (Petitioner’s reliance on this disclosure in Choulis). Patent Owner argues

that the appearance of the phrase “as described above” in this disclosure links PVK, but not PMMA, to the Figure 4 embodiment. *Id.*

We are not persuaded that Patent Owner identifies a basis for adopting so narrow a reading of Choulis’s disclosure. *See* Ex. 1004 ¶ 44. To be sure, Figure 4 teaches PVK as the first host material. *See* Ex. 1004, Fig. 4 (labeling the first host material as PVK). But the text of Choulis expands that teaching to “other embodiments,” including one in which PMMA replaces PVK in “the light emitting layer” that is “described above” in Figure 4. *Id.* ¶ 44; *see* Pet. 29.

Patent Owner argues, for all practical purposes, that the phrase “as described above” in the first part of the paragraph somehow is divorced from the rest of the paragraph, which plainly refers to an embodiment in which PMMA is a suitable replacement for PVK in Choulis’s organic functional layer. Resp. 34–35. It makes little sense that Choulis, in the second part of this paragraph, is discussing a substitution unrelated to Figure 4. Petitioner acknowledges that the phrase “as described above” in the first part of the paragraph unambiguously refers to PVK and Figure 4. *See* Ex. 1004, Fig. 4, ¶ 44; *see especially* Resp. 35 (admitting that an ordinarily skilled artisan “would understand the reference to ‘as described above’ for PVK refers to its use in the Figure 4 embodiment”). Where the second part of the paragraph is describing suitable alternatives for PVK, including PMMA, we reject Patent Owner’s argument that Choulis does not link PMMA to the Figure 4 embodiment. *See* Ex. 1004, Fig. 4, ¶ 44.

Patent Owner also emphasizes that Choulis identifies PMMA “as an example of ‘insulated matrices,’” then faults Petitioner and Petitioner’s witness, Dr. Holmes, for failing to assert “that PVK” similarly is “an

insulative matrix” that is “capable of transporting holes.” *Id.* at 35. We do not agree with Patent Owner that such a showing is necessary to make out, on this record, the ground based on anticipation. To the extent Patent Owner suggests that differences between PVK and PMMA somehow eradicate Choulis’s instruction to replace PVK with PMMA in the Figure 4 embodiment, that argument is outweighed by the plain instruction within the four corners of Choulis. Ex. 1004 ¶ 44.

Choulis explicitly teaches an embodiment in which “PMMA,” although a “host” material that lacks “transport properties,” replaces PVK “[i]n some embodiments,” ***notwithstanding*** that PVK, unlike PMMA, has “mostly hole transporting properties.” Ex. 1004 ¶ 44. In view of that clear disclosure within the applied reference, we find unpersuasive Patent Owner’s view that Petitioner was required to prove, in contravention of the disclosure, that PVK and PMMA both are “insulative matrix” materials “capable of transporting holes.” Resp. 35. Choulis explicitly teaches an embodiment in which PMMA replaces PVK in the Figure 4 “as described above,” ***notwithstanding*** any differences between PMMA and PVK. Ex. 1004 ¶ 44.

For these reasons, we find the phrase “as described above” does not confine Choulis’s teachings about Figure 4 exclusively to the embodiment that includes PVK as the first matrix material. To the contrary, Choulis expressly identifies (and, thereby, anticipates) an embodiment in which PMMA replaces PVK as the first matrix material in “the light emitting layer” that is “described above” in Figure 4. Ex. 1004 ¶ 44; *see* Reply 10 (“[T]he distinction between PVK being non-insulating and PMMA being

insulating does not undermine Choulis’s express teaching to use PMMA” in place of PVK in the Figure 4 embodiment.) (citing Ex. 1004 ¶ 44).

(2) Yang’s Teachings as Undermining Choulis’s Disclosures

Second, Patent Owner argues that Choulis uses an “optimized layer formulation” that is described in Yang, therefore, Choulis’s disclosure is constrained by the fact that “Yang limits its finding to devices with an emission layer having both PVK and PBD.” Resp. 36 (citing Ex. 1017, 2478; Ex. 2019 ¶¶ 70–72). That argument is not persuasive to undercut this challenge. In particular, for reasons well-stated by Petitioner, we determine that “Yang’s emphasis on PVK does not undermine Choulis’s teaching to use PMMA” as a known, interchangeable alternative to PVK in Choulis’s Figure 4 embodiment. Reply 11–12 (Ppetitioner’s emphasis omitted) (citing Ex. 1044 ¶ 32).

We agree with Petitioner that “Yang does not teach against the use of PMMA. If anything, Yang illustrates how tuning the composition to the hold transporting material TPD in PVK is a standard practice for optimizing device performance,” and that “same approach would be applicable for a device utilizing PMMA” in the embodiment in which PMMA replaces PVK in Choulis’s Figure 4. *Id.* at 12 (citing Ex. 1017, Table I; Ex. 1044 ¶ 32).

For these reasons, we reject Patent Owner’s position that Yang’s emphasis on PVK undercuts Choulis’s teaching (Ex. 1004 ¶ 44) to use PMMA instead of PVK in the Figure 4 embodiment.

(3) Additional Dispute Surrounding Claims 4 and 16

Third, with respect to claims 4 and 16, Patent Owner submits, “Ppetitioner’s rationale that PMMA has a lower charge carrier mobility than PBD and TPD lacks support of competent evidence.” Resp. 41 (citing

Pet. 33). According to Patent Owner, “Petitioner argues that because PMMA is described as not having transport properties, it has a lower charge carrier mobility.” *Id.* In Patent Owner’s view, however, the inventors of the ’164 patent made clear in the specification that, “[i]f a charge carrier transport does not take place in a matrix material, then that can be attributed to the fact that charge carriers are not created *or* that there is no mobility of the charge carrier.” *Id.* (Patent Owner’s emphasis) (quoting Ex. 1001, 2:64–3:1).

In view of those facts, Patent Owner argues, “Petitioner has not demonstrated why the lack of charge transport is due to low charge carrier mobility instead of near zero charge carrier density.” *Id.* “For instance,” Patent Owner continues, “if PMMA does have a deep lying HOMO and high lying LUMO, then it may be more difficult to create holes and electrons, leading to a negligible number of holes/electrons created.” *Id.* (citing Ex. 2019 ¶ 89). Further, a “lack of holes and electrons can also result in (pure) PMMA not participating in charge transport” according to Patent Owner and, consequently, “there is no competent evidence of PMMA’s charge carrier mobility being lower than those of TPD and PBD” as required by claims 4 and 16. *Id.* (citing Ex. 1001, 2:64:3:1; Ex. 2019 ¶ 89).

Petitioner counterargues that Patent Owner is incorrect, noting that Choulis on its face “discloses that ‘insulated matrices’ such as PMMA ‘do[] not have transport properties’” yet also expressly teaches substituting PMMA for PVK in the Figure 4 embodiment. Reply 12 (quoting Ex. 1004 ¶ 44); *see* Pet. 26 (similarly quoting Ex. 1004 ¶ 44). Petitioner refers the Board to Dr. Holmes’s testimony that “PMMA has a lower charge carrier mobility compared to TPD or PBD.” Reply 12 (citing Ex. 1044 ¶ 34). As Dr. Holmes explains, moreover, “TPD and PBD are well-known, frequently

used materials for hole and electron transport, with high mobilities of approximately 10^{-3} cm²/Vs and 10^{-5} to 10^{-4} cm²/Vs, respectively. *Id.* (citing Ex.1034, 761; Ex.1037, Fig. 4). “Conversely, PMMA is an insulator and dielectric—an application suitable for a material characterized by high resistivity and low charge carrier mobility.” *Id.* (citing Ex. 1044 ¶ 34 (citing Ex. 1038, 092116–1)).

We determine that Petitioner has the better position regarding the charge carrier mobility dispute surrounding claims 4 and 16. We find persuasive Dr. Holmes’s testimony, which is well-supported by intrinsic, objective proof, that PMMA has a lower charge carrier mobility compared to TPD or PBD. Ex. 1044 ¶¶ 33, 34 (Dr. Holmes’s well-reasoned opinion testimony, as supported by Ex. 1004 ¶ 44; Ex. 1034, 761; Ex. 1037, Fig. 4; Ex.1038, 092116–1)); *see* Pet. 26 (quoting Ex. 1004 ¶ 44); Reply 12 (citing Ex. 1044 ¶¶ 33, 34); *see also* Ex. 1003 ¶ 105 (Dr. Holmes’s further opinion testimony on point, as supported by Ex. 1004 ¶ 44).

Perhaps most significantly, that finding comports with Choulis’s teaching of an embodiment in which PMMA replaces PVK in the Figure 4 embodiment to achieve a functional light emitting layer. Ex. 1004 ¶ 44.

(4) Conclusion: Anticipation of Claims 2, 4, 15, and 16 by Choulis

On this record, Petitioner demonstrates by a preponderance of the evidence that Choulis anticipates claims 2, 4, 15, and 16. Specifically, Petitioner advances compelling evidence that Choulis expressly describes a light emitting layer that includes PMMA in place of PVK in Choulis’s Figure 4, and, further, that this embodiment anticipates claims 2, 4, 15, and 16. Pet. 29–31, 33, 43–48; Reply 10; Ex. 1004, Fig. 4, ¶ 44; Ex. 1044 ¶ 22.

ii. Claim 10

We next address the challenge against the patentability of claim 10 as anticipated by Choulis. Pet. 35–36. Claim 10 depends from claim 1 and further requires:

wherein the LUMO of the emitter material is energetically lower than the LUMO of the first, second, and third matrix materials, and the HOMO of the emitter material is energetically higher than the HOMO of the first, second and third matrix materials.

Ex. 1001, 9:55–59.

Petitioner relies on Choulis’s disclosure of rubrene as the “emitter material” in claim 10. Pet. 35. In particular, Petitioner argues that Choulis expressly teaches a device, doped with rubrene as the emitter material, that meets the LUMO and HOMO requirements of claim 10. *Id.* at 35–36 (citing Ex. 1003 ¶¶ 115, 116; Ex. 1010,¹² 756–757; Ex. 1024,¹³ Fig. 5).

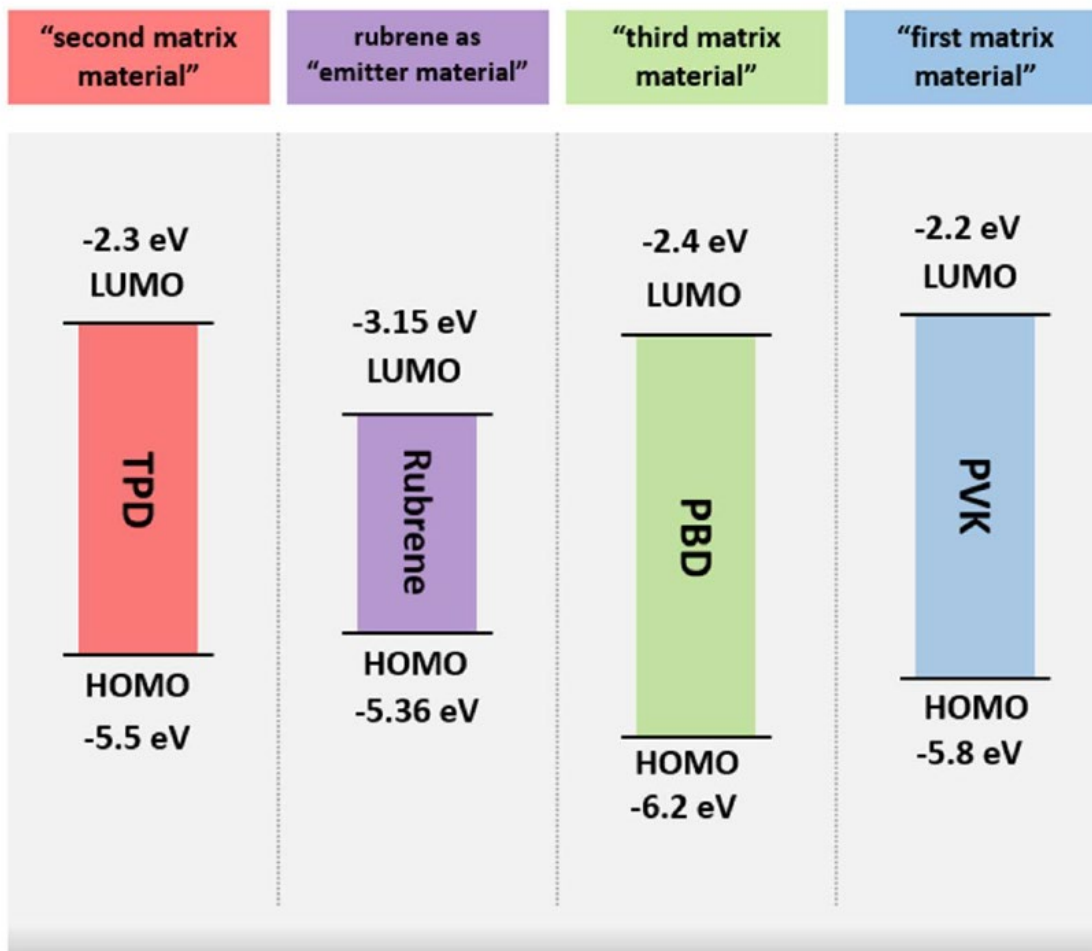
Petitioner, in that regard, argues that “Choulis discloses that, ‘[i]n accordance with embodiments of the invention,’ the light emitting layer” (that is, the organic functional layer) “may incorporate other electroluminescent small molecules like Ir(mppy)₃ or, alternatively, rubrene.” Reply 13 (quoting Ex. 1004 ¶ 43).

Petitioner here relies on the organic functional layer depicted in Choulis’s Figure 4, which employs PVK, TPD, and PBD, respectively, as the first, second, and third matrix materials, and Ir(mppy)₃ rubrene as the

¹² H.Y Kang and C.H. Lee, *Electroluminescence Properties of Organic Light-Emitting Diodes with a Red Dye Doped into Alq3: Rubrene Mixed Host*, 45(3) J. Korean Physical Soc’y 756–760 (Sept. 2004).

¹³ Yugi Hamada et al., *Red organic light-emitting diodes using an emitting assist dopant*, 75 Appl. Phys. Lett. 1682–1684 (1999).

emitter material. *See* Ex. 1004, Fig. 4. In Petitioner's view, Choulis expressly teaches replacing Ir(mppy)₃ with rubrene as the emitter material in this Figure 4 embodiment. Pet. 35. Petitioner and Petitioner's witness, Dr. Holmes, submit that this embodiment would be characterized by HUMO and LUMO relationships as illustrated in the following figure:



Pet. 36 (quoting Ex. 1003 ¶ 115 (Dr. Holmes's declaration testimony)). Petitioner's figure depicts the relative HUMO and LUMO levels of an organic functional layer that is doped with rubrene, where the organic functional layer comprises a first matrix material that is PVK, a second matrix material that is TPD, and a third matrix material that is PBD. This figure illustrates that the LUMO of the rubrene (that is, the "emitter

material”) is energetically lower than the LUMO of the first, second, and third matrix materials, and the HOMO of the rubrene is energetically higher than the HOMO of the first, second and third matrix materials.

Patent Owner counterargues that Choulis does not teach a Figure 4 embodiment in which Ir(mppy)_3 is replaced with rubrene. Resp. 42. In Patent Owner’s view, “nothing in Choulis links the use of rubrene to the Figure 4 embodiment.” *Id.* “In fact,” Patent Owner argues, “Choulis discloses the opposite.” *Id.* On that point, Patent Owner identifies Choulis’s description of “the use of a PBD interface or matching layer whose LUMO level at -2.4 eV is ‘approximately equal to that of Ir(mppy)_3 ,’ to facilitate ‘directly inject[ing] electrons into the Ir(mppy)_3 .’” *Id.* at 43 (quoting Ex. 1004 ¶ 29; citing Ex. 1004 ¶ 28; Ex. 2019 ¶ 91). Referring to that disclosure, Patent Owner argues, “Choulis desires to have the LUMO energy level of the emitter material to be substantially the same as the LUMO level of at least one of the interface materials on the cathode side, that is, within 0.1-0.2eV of the LUMO energy level of an interface material on the cathode side.” *Id.* (citing Ex. 1004 ¶ 42). According to Patent Owner, if one accepts Petitioner’s view that “rubrene has a LUMO at -3.15 eV,” then “[t]his is about 0.75 eV lower than the -2.4 eV LUMO level reported for PBD.” *Id.* (citing Pet. 36; Ex. 1004, Fig. 4; Ex. 2019 ¶ 91).

Patent Owner comes forward with additional argument and evidence that “[r]eplacing Ir(mppy)_3 with rubrene would directly undermine Choulis’s stated reason for using PBD and TPD, which is to have a recombination zone ‘throughout the layer.’” *Id.* at 44 (quoting Ex. 1004 ¶ 32). Patent Owner concludes, on that basis, that the change proposed by Petitioner “eviscerates the role intended by PBD and undoes the expansion of the

recombination zone,” thereby “undermining Choulis’s intended operation” such that this challenge based on obviousness fails. *Id.*

Taking account of the evidence presented by the parties, we determine the Petitioner has the better position on whether Choulis would have suggested to an ordinarily skilled artisan the replacement of rubrene with Ir(mppy)₃ as the doped emitter material in the organic functional layer depicted in Figure 4. In particular, we agree with Petitioner that, although Choulis mentions the desirability of having a relative LUMO level difference of, for example, 0.2 eV, such a difference is not “a mandatory requirement” for the Figure 4 embodiment. Reply 13. “Consistent with this understanding,” moreover, “only Choulis’s dependent claim 10 specifies that ‘the first interfacial layer has a LUMO level that is within 0.2eV,’ while Choulis’s independent claims 1 and 7, from which claim 10 depends, do not impose this limitation.” *Id.* n.9.

Although Choulis discusses preferential LUMO relationships obtained when rubrene and PBD are paired in the organic functional layer, that discussion does not obviate Choulis’s unambiguous teaching of an embodiment in which rubrene replaces Ir(mppy)₃ in the Figure 4 embodiment. Ex. 1004 ¶ 43. That clear intrinsic disclosure fully supports the proposed substitution, and outweighs Patent Owner’s position that, in essence, by following the explicit teachings of Choulis, one “eviscerates” the “intended operation” of Choulis’s device. Resp. 44.

Focusing on the express disclosures in Choulis advanced by the parties (including Ex. 1004 ¶¶ 32, 43), we determine that Patent Owner’s arguments do not outweigh the objective proof advanced by Petitioner; namely, Choulis’s explicit teaching that, “[i]n accordance with

embodiments of the invention,’ the light emitting layer may incorporate other electroluminescent small molecules like Ir(mppy)₃ or, alternatively, rubrene.” Reply 13 (quoting Ex. 1004 ¶ 43)) & n.9. Patent Owner, by contrast, directs us to a disclosure that expresses a mere preference for co-doping with “matching material” to “increase the recombination zone” (Ex. 1004 ¶ 32; *see* Resp. 44), whereas Petitioner directs us to a disclosure that pointedly anticipates an embodiment in which Ir(mppy)₃ replaces rubrene in the Figure 4 embodiment (Ex. 1004 ¶ 43; *see* Pet. 35–37).

In a nutshell, we agree with Petitioner that Choulis “explicitly teaches the substitution of rubrene for Ir(mppy)₃” in the Figure 4 embodiment. Reply 13; Ex. 1004 ¶ 43. Patent Owner’s counterarguments, which focus on Choulis’s stated *preference* for maintaining a specific relationship, as between the LUMO level of the emitter material and the LUMO level of an interface material on the cathode side, do not erase Choulis’s *explicit teaching* of an organic functional layer in which rubrene replaces Ir(mppy)₃ as the emitter material in Figure 4. *Id.* at 13–14; Ex. 1004 ¶ 43; *see* Ex. 1003 ¶ 95; Ex. 1044 ¶ 36 (Dr. Holmes’s persuasive supporting testimony).

For these reasons, we determine that Petitioner establishes by a preponderance of the evidence that Choulis anticipates claim 10 based on Choulis’s explicit teaching of an organic functional layer in which Ir(mppy)₃ replaces rubrene as the emitter material in Figure 4. Ex. 1004 ¶ 43; Pet. 35–37; Reply 13–16 (and evidence cited therein).

iii. Claims 13 and 14

Claims 13 and 14 are directed to methods of producing “an electronic device according to claim 1.” Ex. 1001, 10:4–5. Claim 13 relates, in relevant part, to a method in which the first, second, and third material materials “are

simultaneously applied,” whereas claim 14 further requires that such simultaneous application is accomplished “by evaporation coating.” *Id.* at 10:13, 10:16–17.

Petitioner maps every limitation of claims 13 and 14 to corresponding disclosures in Choulis. Pet. 38–43. For evidence that Choulis anticipates application by evaporation, however, Petitioner directs us to a background reference, Djobo,¹⁴ which indicates that “PVK can be deposited via evaporation when manufacturing” organic light emitting devices. Pet. 41 (citing Ex. 1023, 1); *see* Ex. 1003 ¶ 133 (Dr. Holmes’s supporting opinion testimony). Petitioner further points out that “Choulis discloses that such ‘small organic molecules . . . are preferably deposited through evaporation.’” Pet. 41 (quoting Ex. 1004 ¶ 43).

Patent Owner counters Petitioner’s evidence by proposing that “Choulis only suggests process polymers as ‘solutions or suspensions,’ and not through evaporation.” Resp. 48 (citing Ex. 2019 ¶ 101; Ex. 1004 ¶¶ 43, 44, 48). Here we are directed to Dr. Sims’s Declaration, in which Patent Owner’s witness opines:

In no part of Choulis does it suggest that its [emitting layer] could be produced by evaporation because Choulis knows that PVK cannot be evaporated. Choulis is specifically about solution processing a multicomponent [emitting layer] that contains an inert polymeric matrix material. Both the HIL/ABL and HTL matching layer (TFB) were solution processed by necessity because they must not be re-dissolved during the [emitting layer] spin-coating step. Solution processing offers the

¹⁴ S. Ouro Djobo et al., *Poly(N-vinylcarbazole) (PVK) deposited by evaporation for light emitting diodes thin films structures*, 122 Metals 131–133 (2001) (Ex. 1023).

advantage of low-temperature processing and is therefore much cheaper than physical vapor deposition.

Ex. 2019 ¶ 101.

Referring again to Dr. Sims’s Declaration, Patent Owner argues that Petitioner’s background reference, Djobo,¹⁵ “demonstrates evaporation of PVK leads to decomposition, and there is no demonstration that the resulting material would have the same HOMO/LUMO levels as PVK or that the decomposed materials would provide acceptable performance.” Resp. 48 (citing Ex. 2019 ¶ 100). Patent Owner then states that Petitioner’s witness, Dr. Holmes, during cross-examination, “admitted that he is not aware of any literature or anyone who has used evaporation to process PVK.” *Id.* (citing Ex. 2020, 163:13–165:6).

We find that Petitioner establishes by a preponderance of the evidence that Choulis anticipates claim 13. We agree with Petitioner, in that regard, that Choulis explicitly teaches “using spin-coating as a method for depositing materials, which involves a simultaneous application process” as required by claim 13. Reply 16 (citing Pet. 40–41; Ex. 1044 ¶ 45).¹⁶ We

¹⁵ Petitioner raises Djobo as a background reference supporting that Choulis anticipates deposition of PVK by evaporation. Pet. 41. Patent Owner counters that Djobo, to the contrary, shows that Choulis does *not* teach deposition of PVK by evaporation. Resp. 48. In other words, both parties cite Djobo in connection with the ground based on anticipation by Choulis. Against that backdrop, we determine that Patent Owner waives any argument that Petitioner improperly cites Djobo as a background reference in support of the anticipation challenge, which is based on Choulis alone. Resp. 48 (nowhere asserting that the challenge is deficient on that basis). That waiver arises because no argument, in that regard, is raised in Patent Owner’s Response *see* Inst. Dec. 34 (“The Board shall deemed waived any issue not raised by Patent Owner in a timely response to the Petition . . .”).

¹⁶ Patent Owner’s statement that “spin coating tends to cause phase separation” is not developed adequately on this record and, therefore, is

further agree with Petitioner that Patent Owner “has not contested this point.” Resp. 48. “Therefore, there is no genuine dispute regarding the unpatentability of claim 13,” although Patent Owner raises “arguments concerning evaporation, which is a distinct process from spin-coating” relevant to the additional limitations of claim 14. Reply 16. We determine that Petitioner establishes by a preponderance of the evidence that Choulis anticipates claim 13.

Patent Owner, however, has the better position on whether Choulis anticipates claim 14, which “includes the requirement of applying matrix materials via evaporation coating.” Reply 16. Petitioner seems to abandon that challenge in the Reply by raising arguments that appear, on this record, to bear exclusively on whether the subject matter of claim 14 would have been obvious over Choulis.¹⁷ *Id.* at 16–17. Those arguments are insufficient to counter Patent Owner’s reasons why Choulis does not anticipate the “evaporation coating” limitation of claim 14. *Compare id.*, with Resp. 48. On this record, therefore, we determine that Petitioner does not establish by a preponderance of the evidence that Choulis anticipates claim 14.

unpersuasive to persuade us “that Choulis does not have three matrix materials.” Sur-reply 15. That argument runs counter to Choulis’s explicit, intrinsic disclosures, which illustrate (Ex. 1004, Fig. 4) and describe (*id.* ¶ 30) an organic light emitting layer composed of three matrix materials. *See* Pet. 24–25 (citing Ex. 1004, Fig. 4, ¶ 30); *see also* Ex. 1003 ¶¶ 85–88 (persuasive declaration testimony of Dr. Holmes, cited at Pet. 24–25).

¹⁷ There is some confusion on this point, given that both parties sometimes collapse, into a single argument, whether Choulis anticipates or renders obvious claim 1. *Compare* Resp. 48, with Reply 16–17.

iv. Claims 3, 5–8, 11, and 12

Patent Owner raises no arguments as to claims 3, 5–8, 11, and 12 that are distinguishable from those presented in connection with claim 1.

Resp. 34–48. Our above assessment of whether Choulis anticipates claim 1 thus applies with equal force to claims 3, 5–8, 11, and 12. Accordingly, we find Petitioner establishes by a preponderance of the evidence that Choulis anticipates claims 3, 5–8, 11, and 12. Pet. 32, 33–35, 37, 38 (and evidence cited therein).

(f) Conclusion: Anticipation of Claims 2–8 and 10–16 by Choulis

For all of the above reasons, we determine that Petitioner establishes by a preponderance of the evidence that Choulis anticipates claims 2–8 and 10–13, 15, and 16. Petitioner does not establish by a preponderance of the evidence that Choulis anticipates claim 14.

D. Ground 2: Obviousness of Claims 1–8 and 10–16 Over Choulis

We next turn to the separate challenge based on Petitioner’s evidence that the subject matter of claims 1–8 and 10–16 would have been obvious over Choulis. Pet. 19–48.

As an initial matter, we observe that both parties entangle their anticipation and obviousness arguments in their briefs. *Compare* Pet. 19–48; Reply 7–17, *with* Resp. 26–47; Sur-reply 12–16; *see supra* n.17. To the extent that the parties’ anticipation and obviousness positions are interconnected, we incorporate herein our findings, presented above, in the context of anticipation.

(a) First Obviousness Analysis: Claims 1–8 and 10–16

As the Federal Circuit has observed, “anticipation is the epitome of obviousness.” *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed.

Cir. 1983). We recognize that anticipation and obviousness “are separate and distinct concepts,” *Jones v. Hardy*, 727 F.2d 1524, 1529 (Fed. Cir. 1984), but “it is commonly understood that prior art references that anticipate a claim will usually render that claim obvious,” *Cohesive Techs., Inc. v. Waters Corp.*, 543 F.3d 1351, 1364 (Fed. Cir. 2008).

Based on our findings above that Choulis anticipates claims 1–8 and 10–13, 15, and 16, we determine that Choulis likewise renders obvious the subject matter of those claims.¹⁸ *See* Pet. 20 (citing Ex. 1003 ¶¶ 72–166) (Dr. Holmes’s cogent explanation of why Choulis anticipates or, in the alternative, renders obvious claims 1–8 and 10–13, 15, and 16).

(b) Alternative Obviousness Analysis: Claims 2, 4, 15, and 16

Petitioner presents alternative reasons why the subject matter of claims 2, 4, 15, and 16 would have been obvious over Choulis. In this section we assess Petitioner’s alternative argument that, even if Choulis does not **expressly** disclose substituting PMMA for PVK, Choulis, at minimum, contains a **suggestion** to do so, such that an ordinarily skilled artisan would have found it obvious to make that substitution. Pet. 31; Reply 10 (citing Pet. 31); Ex. 1003 ¶ 100; Ex. 1044 ¶ 23. We agree with Petitioner for two independent reasons, which we address in the next subparts of our analysis.

i. PVK and PMMA as Interchangeable Host Materials

First, Petitioner directs us to compelling intrinsic evidence that an ordinarily skilled artisan would have recognized PMMA as an interchangeable or “alternative” host material suitable for replacing PVK in

¹⁸ This rationale does not apply to claim 14 because, as explained in our analysis above, Petitioner does not prove by a preponderance of the evidence that Choulis anticipates claim 14

the light emitting layer illustrated in Choulis's Figure 4. Choulis describes PVK as "a host material in the Figure 4 embodiment" and "further teaches that insulated hosts such as PMMA may be used as an alternative" to PVK. *Id.* (citing Ex. 1004 ¶¶ 30, 44); *see* Ex. 1044 ¶ 22; *see also* Ex. 1003 ¶ 97.

Here again, we take account of Patent Owner's view that PVK and PMMA exhibit differences that stem from the fact that the former transports holes and the later does not. Resp. 35. Those differences do not diminish, much less erase, the express teaching in Choulis that PVK and PMMA are interchangeable alternatives, both suitable for use as the first host material in Choulis's "light emitting layer." *Compare* Ex. 1004 ¶ 44, *with* Sur-reply 14–15 (and evidence cited therein).

Patent Owner argues, in practical effect, that the challenge is deficient because Petitioner fails to prove that PMMA and PVK are perfectly interchangeable, given that "PMMA is a wider energy gap insulating material" as compared to PVK. Sur-reply 14 (citing Reply 10). But within the four corners of the applied reference, Choulis makes crystal clear that perfect interchangeability is not required: To the contrary, a "**hole transporting**" material, such as "PVK," is interchangeable with a different "host" material that "**does not have transport properties**, such as . . . PMMA." Ex. 1004 ¶ 44 (Board's emphasis).

In other words, "the distinction between PVK being non-insulating and PMMA being insulating" does not undercut "Choulis's explicit teaching to use PMMA" as a suitable, alternative material in the Figure 4 embodiment. Reply 10 (citing Ex. 1004 ¶ 44). Patent Owner's argument that an ordinarily skilled artisan would not have recognized PMMA and PVK as suitable alternatives, because they have different transport properties, is

contrary to the intrinsic disclosure of the reference. Resp. 35. Choulis explicitly acknowledges those very same differences yet lists both materials as suitable for use in “the light emitting layer.” *Ibid.*

On this record, therefore, we determine that Choulis, at minimum, suggests that a person of ordinary skill in the art at the time of the invention would have recognized PMMA as a suitable alternative to PVK in Choulis’s Figure 4 embodiment, notwithstanding any differences raised by Patent Owner. Ex. 1004 ¶ 44. Patent Owner’s argument that no disclosure in Choulis suggests that an ordinarily skilled artisan “would have found it desirable to use PMMA in place of PVK in Choulis’s devices” misses the mark, where Choulis includes both PMMA and PVK in lists of materials suitable for use as host or matrix materials. Resp. 38; Ex. 1004 ¶ 44.

“Our caselaw is clear. It’s not necessary to show that a combination is ‘the *best* option, only that it is a *suitable* option.’” *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021). Even if Choulis does not expressly disclose substituting PMMA for PVK in the Figure 4 embodiment, “an ordinarily skilled artisan would have found it obvious to make that substitution.” Reply 10 (citing Pet. 31 (citing Ex. 1003 ¶ 100; Ex. 1044 ¶ 23)). The suggestion for that substitution is set forth unambiguously in Choulis’s listing of both “PVK” and “PMMA” as materials suitable for use as a first “host” material in Choulis’s organic functional layer; that is, “the light emitting layer” that is “described above” in Figure 4. Ex. 1004 ¶ 44.

ii. Alternative Reasoning for Replacing PVK with PMMA

Patent Owner counterargues that using PPMA in place of PVK would have been understood to “upset the hole and electron balance,” as well as “affect hole-charge recombination,” and “degrade the performance of the

resulting OLED system.” Resp. 37. Petitioner responds with evidence that “it would have been a routine task for” an ordinarily skilled artisan “to optimize the composition of each component within the light-emitting layer to achieve the desired charge balance.” Reply 11 (citing Ex. 1004 ¶ 24).

Petitioner’s response brings to light a second reason why an ordinarily skilled artisan would have been prompted to carry out the proposed modification of replacing PVK with PMMA in Choulis’s Figure 4. Specifically, Petitioner directs us to evidence that an ordinarily skilled artisan would have recognized “that PMMA’s wide energy gap is advantageous for minimizing interference with charge transport in other matrix materials, thereby simplifying device design and optimization.” Reply 10 (citing Ex. 1003 ¶ 100; Ex. 1044 ¶ 23). As explained by Petitioner’s witness, Dr. Holmes, the ordinarily skilled artisan, “aiming to minimize or prevent charge transport in the first matrix material,” would have been led to “choose a wider energy gap insulating material, like PMMA, in place of PVK, which is a known hole transporter with a narrower energy gap.” *Id.* (citing Ex. 1044 ¶ 23).

iii. Reasonable Expectation of Success

Petitioner directs us to compelling evidence that an ordinarily skilled artisan would have “reasonably expect[ed] success in constructing an” organic light emitting device “based on PMMA, and further in combining PMMA with additional charge transport materials such as TPD.” Reply 10 (citing Ex. 1044 ¶¶ 24–30 (citing Ex. 1017, Fig. 2b; Ex. 1034, 762–763, Fig. 1; Ex. 1035, 331–332; Ex. 1036, L937–938, Fig. 2)). We agree with Petitioner that Patent Owner focuses on immaterial characteristics of “some ultra-wide energy gap hosts,” but stops short of presenting persuasive proof

that those characteristics are material to whether “PMMA’s HOMO and LUMO levels meet the claim requirements.” Reply 11 (citing Ex. 1044 ¶ 31). On this record, therefore, we determine that Petitioner explains adequately how and why an ordinarily skilled artisan would have undertaken the proposed modification with a reasonable expectation of success. *See* Pet. 31 (Petitioner’s compelling arguments and evidence on point).

(c) Alternative Obviousness Analysis: Claim 10

Petitioner presents alternative reasons why an ordinarily skilled artisan, equipped with Choulis’s disclosure, would have been led to the subject matter of claim 10. “To the extent Choulis does not expressly disclose this claim,” Petitioner argues, the artisan of ordinary skill would have been prompted to use an emitter material in Choulis’s organic functional layer having “a LUMO level energetically lower than the LUMO levels of PVK (i.e., the ‘first matrix material[’]), TPD (i.e., the ‘second matrix material’), and PBD (i.e., the ‘third matrix material’), and a HOMO level energetically higher than the HOMO levels of PVK, TPD, and PBD.” Pet. 36 (citing Ex. 1003 ¶ 115).

Petitioner advances compelling objective proof that it would have been obvious to replace the rubrene in Choulis’s Figure 4 embodiment with PQIr or DCM2, and that such a replacement would result in a light emitting layer that satisfies the HOMO and LUMO levels required by claims 2, 4, 15, and 16. *Id.* at 36–37 (citing and discussing background references; namely,

Kanno¹⁹ (Ex. 1025, Fig.2) and Hamada (Ex. 1024, Fig. 5)); *see* Reply 13–16 (additional argument and evidence on point).²⁰

We agree with Petitioner that “[e]lectrons tend to lower their energy by traveling ‘downhill’ to LUMO levels that are lower, and in contrast, holes tend to lower their energy by traveling ‘uphill’ to HOMO levels that are higher.” Pet. 36–37 (quoting Ex. 1003 ¶¶ 27, 115). We further agree that, “[t]o ensure that all charges efficiently travel to the guest emitter material to form excitons,” an ordinarily skilled artisan would have understood to select a “guest emitter material” having a LUMO level that “is preferably lower than those of other materials in the light emitting layer,” and having a HOMO level “preferably higher than those of other materials in the light emitting layer.” *Id.* at 37 (citing Ex. 1003 ¶ 115). That artisan “would have known that examples of such emitter materials include PQIr and DCM2.” *Id.* at 36 (citing Ex. 1003 ¶ 115; Ex. 1024, Fig. 5; Ex. 1025, Fig. 2 (caption)).

Petitioner directs us to additional persuasive evidence that the ordinarily skilled artisan “would have had a reasonable expectation of success in using such an emitter material” because “such use was well-

¹⁹ Hiroshi Kanno et al., *White Stacked Electrophosphorescent Organic Light-Emitting Devices Employing MoO₃ as a Charge-Generation Layer*, 18 Adv. Mater. 339–342 (2006).

²⁰ Petitioner does not include Kang, Kanno, or Hamada in the identification of this challenge, which is based on obviousness over Choulis. Pet. 6 (grounds chart). Patent Owner raises no argument (and, thereby, effectively waives any argument) that those references should have been so identified, or that the challenge is deficient for failure to do so. Resp. 42–47; *see* Inst. Dec. 34 (“The Board shall deemed waived any issue not raised by Patent Owner in a timely response to the Petition . . .”); *see also supra* n.15 (discussing a similar waiver in connection with Petitioner’s citation to Djobo as a background reference in the challenge based on anticipation by Choulis).

known around 2008 and implementing it in Choulis's" device "would have been a routine matter" requiring no more than exercise of ordinary skill in the art. *Id.* (citing Ex. 1003, ¶¶ 115, 130, 131; Ex. 1006, Fig. 8).

We find no merit in Patent Owner's counterargument that neither PQIr nor DCM2 "would have complied with Choulis's operating principle of having matching HOMO/LUMO energy levels between the emitting material and at least the interfacial materials," because PQIr has a LUMO level of "-2.7 eV" and DCM2 has a LUMO level of "-3.11 eV." Resp. 45 (citing Pet. 36–37; Ex. 1004 ¶ 6, 7; Ex. 2019 ¶ 96; Ex. 1025; Ex. 1024). This is essentially the same argument raised by Patent Owner, which we reject above, in the context of whether Choulis anticipates claim 10. Even if Choulis states a *preference* "for having matching HOMO/LUMO energy levels" as Patent Owner argues (Resp. 45), that preference is not shown to be mandatory, where Choulis's *explicitly* discloses the suitability of alternative emitter materials that *do not* maintain that relationship. Ex. 1004 ¶ 44.

On this record, we agree with Petitioner that an ordinarily skilled artisan would have recognized the suitability of replacing rubrene, in Choulis's Figure 4 embodiment, with other known emitter materials, including PQIr and DCM2, which would have been understood to achieve the necessary charge mobilities. *See* Pet. 36–37; Ex. 1003 ¶¶ 27, 115. The replacement of one known element with another suitable, known, interchangeable alternative is not inventive, absent a showing of unpredictable results. *See KSR Int'l v. Teleflex Inc.*, 550 U.S. 398, 416 (2007) ("[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.");

see also In re Mayne, 104 F.3d 1339, 1340 (Fed. Cir. 1997) (“Because the applicants merely substituted one element known in the art for a known equivalent, this court affirms [the conclusion of obviousness].”).

Patent Owner neither contends that rubrene in Figure 4 achieves an unpredictable result, nor proposes that the replacement of rubrene with PQIr or DCM2 would render inoperable Choulis’s device. *See* Resp. 45–47. Even if, as Patent Owner contends, Choulis expresses a general **preference** for a device in which rubrene is selected from the known alternative options, we are directed to no disclosure in Choulis that “criticize[s], discredit[s], or discourage[s]” investigation into modified devices in which a known suitable, even if potentially **less preferable**, alternative is selected to replace rubrene. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004).

Patent Owner observes that neither Kanno nor Hamada (the two background references that Petitioner advances to show that PQIr and DCM2 were known emitter materials) teaches the use of those emitter materials “with TPD, PBD, or PVK” as matrix materials. Resp. 46. That observation is unpersuasive to undercut the challenge because Petitioner relies on Choulis, not on those background references, for teaching an organic functional layer having TPD, PBD, and PVK as matrix materials. Pet. 36–37; Ex. 1004, Fig. 4.

Similarly, Patent Owner argues that neither Kang nor Hamada “suggests using rubrene as an emitter material as required by claim 10.” Resp. 45. First, we observe, claim 10 does not require the use of rubrene as the emitter material. Ex. 1001, 9:4–22, 9:55–59. Second, to the extent Patent Owner means to argue that neither of these background references supports Petitioner’s view that it would have been obvious to replace Ir(mppy)₃ with

rubrene in Choulis’s Figure 4, we find that argument unpersuasive. Based on our review of Kang and Hamada, we agree with Petitioner that those background references do nothing to “diminish Choulis’s” explicit teaching “regarding the use of rubrene” as the emitter material in Figure 4. Reply 14 (citing Ex. 1004 ¶ 39).

We next turn to Patent Owner’s argument that “the cited references do not support Petitioner’s theory that” an ordinarily skilled artisan “would have found it obvious to have the LUMO of the guest emitter material lower than those of other materials in the light emitting layer, and the HOMO level of the guest emitter material higher than those of the other materials in the light emitting layer.” Resp. 46 (citing Ex. 2019 ¶ 97). That argument is not persuasive: Petitioner, in fact, directs us to compelling evidence, tethered to explicit disclosures in Choulis, which support the very proposition. Reply 10–12 (citing Choulis (Ex. 1004) and Dr. Holmes’s declarations (Exs. 1003, 1044)). Petitioner’s witness, Dr. Holmes, provides persuasive testimony on this point; testimony tethered to Choulis’s teachings and additional, persuasive, objective supporting evidence (Exs. 1017, 1034–1036); *see also* Pet. 31.

On this record, therefore, we determine that Petitioner establishes by a preponderance of the evidence that the subject matter of claim 10 would have been obvious over Choulis.

(d) Obviousness Analysis: Claim 14

Claim 14 depends directly from claim 13 and indirectly from claim 1. Ex. 1001, 10:4–5, 10:14–17. Specifically, claim 13 covers the method of claim 13, in which the first, second and third matrix materials of claim 1 “are simultaneously applied,” and additionally requires that those materials

“are applied by evaporation coating.” *Id.* For reasons explained above, Petitioner fails to establish that Choulis anticipates claim 14.

In this section, we address Petitioner’s alternative position that the subject matter of claim 14 would have been obvious over Choulis. Pet. 38–43; Reply 16–17. On that point, Petitioner explains, “[t]he evaporation process involves heating materials so that their molecules are released and subsequently travel through a vacuum chamber to be deposited simultaneously on a target substrate.” Pet. 41 (citing Ex. 1003 ¶ 132).

Petitioner directs us to persuasive evidence, within the four corners of Choulis, indicating that “small molecules” in Choulis’s process “are preferably deposited through evaporation.” *Id.* (quoting Ex. 1004 ¶ 43). Petitioner directs us to additional persuasive evidence that “TPD and PBD are both small organic molecules,” which, according to the explicit teachings of Choulis, “are preferably deposited through evaporation.” *Id.* (citing Ex. 1003 ¶ 133; Ex. 1021, Fig. 1; Ex. 1022, 203502–2).

We take account of the fact also that Choulis, in that same paragraph that discusses evaporation deposition for small molecules, discusses different methods that are suitable for applying “[p]olymer organic layers” such as PVK (including, for example, “ink-jet printing an organic solution or by spin-coating”). Ex. 1004 ¶ 48. In view of that disclosure, we agree with Patent Owner that “Choulis does not propose using [an] evaporative process with polymers,” like PVK. Sur-reply 16 (quoting Ex. 2020, 173:1–11).

To be clear, Choulis does not limit the application of polymer organic layers such as PVK to processes of ink-jet printing or spin-coating, but states that such layers “can be applied to the substrate using a variety of techniques.” Ex. 1004 ¶ 48. But in the same paragraph, Choulis identifies

evaporative processes as useful when applying small molecules, such as TPD and PBD, without mentioning PVK. *Id.* The main dispute, on this record, is whether an ordinarily skilled artisan would have been prompted to apply PVK by evaporation when manufacturing Choulis’s Figure 4 embodiment. *Compare* Reply 12 and Pet. 41–42, with Resp. 48 and Sur-reply 15–16.

We resolve this dispute in favor of Petitioner. Petitioner directs us to persuasive evidence that, at the time of the invention, it would have been well-known that PVK is capable of deposition “via evaporation when manufacturing” organic light emitting devices. Pet. 41 (citing Ex. 1023, 1); *see* Ex. 1003 ¶ 133. Petitioner argues, and we agree, that Djobo demonstrates persuasively that a person of ordinary skill in the art at the time of the invention would have been aware that an “evaporated PVK layer would” transport charge and emit light, thereby leading to “acceptable performance.” Reply 17 (citing Ex. 1023, 1, 133 (relevant disclosures in Djobo); Ex. 1044 ¶ 47 (Dr. Holmes’s persuasive testimony)).²¹

²¹ Petitioner misstates the record in the Reply, arguing that “Choulis discloses evaporation coating as a method, *and* that PVK can be deposited using this technique.” Reply 17 (Board’s emphasis) (citing Pet. 41–42; Ex. 1044 ¶ 47). The evidence cited by Petitioner makes plain that Choulis does *not* explicitly teach “that PVK can be deposited using this technique.” *Id.*; *see* Ex. 1004 ¶ 48 (relevant disclosure in Choulis); Ex. 1004 ¶ 47 (opinion testimony of Petitioner’s own witness). “Choulis discloses evaporation coating as a method” (Ex. 1044 ¶ 42), but not for PVK (*see* Ex. 1004 ¶ 48; Pet. 41–42). Both Petitioner and its witness, Dr. Holmes, moreover, rely on a background reference (namely, Djobo (Ex. 1023)), *not* Choulis, to show that “evaporation coating” (Reply 17; Ex. 1044 ¶ 47) would have been a known method for depositing PVK on the substrate of Choulis’s device. Pet. 41–42; Ex. 1044 ¶ 47. Accordingly, we view Petitioner’s misstatement of the record as unintentional, harmless error.

Patent Owner’s observation that “Djobo demonstrates evaporation of PVK leads to decomposition” in some applications does not denigrate Petitioner’s evidence that an ordinarily skilled artisan would have recognized the feasibility and desirability of depositing PVK by evaporation in Choulis’s device. Resp. 48. On that point, Petitioner establishes by a preponderance of the evidence that the proposed modification would have been understood to provide specific benefits, such as improved “manufacturing, display quality, and yield, particularly when compared to other manufacturing methods such as spin coating” (Pet. 41–42 (citing Ex. 1003 ¶¶ 132–134 (detailing the feasibility and desirability of depositing PVK by evaporation in Choulis’s device); Ex. 1023, 1 (Djobo’s disclosure); Ex. 1044 ¶¶ 47, 48 (Choulis’s disclosure))). Patent Owner does not contest that evidence effectively, if at all. Resp. 48; Sur-reply 15–16.

Nor do we find persuasive Patent Owner’s view that Petitioner’s witness, Dr. Holmes, during cross-examination was unaware “of any literature or anyone who has used evaporation to process PVK.” Resp. 48 (citing Ex. 2020, 163:13–165:6). Petitioner effectively counters that view by pointing to evidence that Dr. Holmes plainly was aware of Djobo, and its significance, when he prepared his declaration and provided his deposition testimony. Reply 17 (citing Ex. 1003 ¶ 133; Ex. 2020, 162:17–163:3).

Petitioner provides an alternative argument with respect to the asserted obviousness of claim 14. Specifically, Petitioner relies on an embodiment in which PVK is not used at all; but instead, “small molecules” are “used as alternatives to PVK.” Reply 17; *see* Pet. 42–43 (for details of this proposed alternative rationale). Patent Owner’s opposition to that alternative rationale is limited to an argument that Petitioner fails to show

that “unspecified small molecules would satisfy the required HUMO/LUMO levels” of claims 13 and 14. Resp. 48. But Petitioner points out that, when “a small molecule material” is selected “as the ‘first matrix material’” in Choulis’s device, an ordinarily skilled artisan still would have been motivated to follow Choulis’s instructions to “preferably” select LUMO and HOMO levels that, ultimately, satisfy the claim limitations. Pet. 42–43.

Patent Owner counterargues that Petitioner “makes no attempt to show that any such unspecified small molecules would satisfy the claims’ HUMO/LUMO levels.” Sur-reply 16 (citing Ex. 2019 ¶ 102). We disagree: Petitioner does more than explain why the selection of small molecules would have been limited to molecules that meet the specified HUMO/LUMO levels. *See* Pet. 42–43. Petitioner directs us to persuasive evidence supporting why an ordinarily skilled artisan would have been motivated to undertake that modification with a reasonable expectation of success. *See id.* (and evidence cited therein); Reply 17 (directing us to additional evidence that “applying small molecules via evaporation coating was a well-established and routine process) (citing Ex. 1044 ¶¶ 44, 48 (citing Ex. 1004 ¶ 43 (Choulis))).

For all of the above reasons, we find Petitioner proves by a preponderance of the evidence that the subject matter of claims 13 and 14 would have been obvious over the disclosure of Choulis.

E. Ground 3: Obviousness of Claim 9 Over Choulis and Yong

Petitioner challenges the patentability of claim 9 on the basis of obviousness over Choulis and Yong. Pet. 48–51. Claim 9 is directed to the device of claim 1, but adds an additional limitation; namely, “wherein the

concentration of the emitter material in the emission layer has a gradient.”
Ex. 1001, 9:52–54.

i. Petitioner’s Arguments and Evidence

The success of this challenge hinges on the adequacy of Petitioner’s argument and evidence that, notwithstanding that Choulis does not disclose expressly the additional limitation of claim 9, an ordinarily skilled artisan would have understood that “[t]he recombination in any of the layers” can be controlled “by adjusting dopant concentration.” Pet. 48–49 (Petitioner’s emphasis) (quoting Ex. 1004 ¶ 2). We must resolve whether, based on that understanding, an ordinarily skilled artisan would have been led “to apply the emitter layer in Choulis’s emission layer such that the concentration of the emitter has a gradient.” *Id.* at 49 (citing Ex. 1003 ¶ 160).

Petitioner directs us to evidence that includes Dr. Holmes’s opinion, which is supported by objective proof in the form of Yong, that “forming a gradient with an emitter material was well known” at the time of the invention and accomplished by ensuring that “the doping concentration of the phosphorescent dye gradually increases or decreases along the direction from the anode layer to the cathode layer with the increase of the thickness of the organic light emitting layer, forming a construction with gradient doping.” *Id.* (citing Ex. 1003 ¶ 161; Ex. 1009, code (57) (Yong’s Abstract)).

The central dispute requiring our resolution is whether an ordinarily skilled artisan would have been prompted to modify Choulis’s device, in view of Yong, to include such a gradient. Petitioner submits that Yong “explains that the benefit of gradient distribution comes from the gradient ‘mak[ing] the distribution trend of phosphorescent dyes in the host material to conform to the distribution trend of electrons in the host material,’” which

“expands the luminescent region of the device, improves the utilization rate of phosphorescent dyes, and is also conducive to the combination of electrons and holes to form excitons.” *Id.* (quoting Ex. 1009, 10²²; Ex. 1003 ¶¶ 162, 163).

In addition, Petitioner advances Yong’s teaching that “this results in benefits including ‘improving the device’s luminescence efficiency and brightness, improving its stability, and overcoming disadvantages of low luminescence efficiency and poor stability under high current.’” *Id.* (quoting Ex. 1009, 10). According to Petitioner and Petitioner’s witness, Dr. Holmes, therefore, it would have been obvious to an ordinarily skilled artisan to modify Choulis’s device in view of Yong “to use a gradient for the emitter concentration in the emission layer” in order to “achieve the advantages discussed in Yong, including improving the device’s luminescence efficacy and stability.” *Id.* at 50 (citing Ex. 1003 ¶ 164).

Finally, Petitioner argues, and cites additional evidence, that the proposed modification would have required no more than exercise of ordinary skill in the art, would have been undertaken with an expectation of success, and would have been suggested based on similarities between Choulis’s and Yong’s organic light emitting devices. *Id.* at 50–51. For example, Petitioner submits, Choulis discloses that its first, second, and third matrix materials are deposited using evaporation, and Yong similarly produces “a gradient composition for the emitter concentration” using “evaporation sources.” *Id.* at 50 (citing Ex. 1004 ¶¶ 44, 48 (Choulis);

²² Although Petitioner refers to original pagination of subject sections, for clarity, we cite numbers added by Petitioner to Exhibit 1009.

Ex. 1003 ¶ 165 (Dr. Holmes’s declaration testimony)) (quoting Ex. 1009, 11 (Yong)).

ii. Patent Owner’s Opposing Arguments and Evidence

Patent Owner opposes this challenge by asserting that Petitioner fails to show adequately that an ordinarily skilled artisan would have been led to make the proposed modification or would have done so with a reasonable expectation of success. Resp. 48–49.

Patent Owner directs us to the Reply Declaration of Dr. Sims, who opines that “Dr. Holmes does not explain why trends observed for *different* devices, all with a uniform emitter concentration within the emission layer, would have suggested having different emitter concentrations through the emission layer in the *same* device. Indeed,” according to Dr. Sims, “Choulis does not teach or suggest a concentration gradient within the device because the inventors of Choulis would have known controlled concentration gradients cannot be achieved via spin-coating. The ability to grow concentration gradients throughout a multicomponent layer is a unique capability of physical vapor deposition.” Ex. 2019 ¶ 104 (Dr. Sims’s emphasis); *see* Resp. 49 (citing this testimony).

In Dr. Sims’s further view, Choulis expresses a preference for “specific deposition techniques” in connection with “small-molecule emitting materials, not simply that ‘various methods and techniques’ can be used, as Dr. Holmes contends.” Ex. 2019 ¶ 105 (citing Ex. 1003 ¶ 160; Ex. 1004 ¶ 43); *see* Resp. 49 (citing this portion of Dr. Sims’s declaration testimony). Citing differences between Yong’s and Choulis’s devices, moreover, Dr. Sims opines that “Dr. Holmes provides no evidence that Choulis suffers from the same problem as Yong, which has a completely

different architecture” in which “the ‘concentration distribution of electrons [also] shows a non-linear decreasing trend along the direction from the electron transporting layer to the hole transporting layer.’” Ex. 2019 ¶¶ 106–108) (alteration in original).

Dr. Sims further opines that Yong’s invention, unlike Choulis’s invention, “was specifically designed to address the non-linear decrease in electron concentrations from” an electron transport layer to an emissive layer, and on that basis, states that “there is no reason to believe that Choulis’s specific device experiences” the same problems, or requires the same solution, as disclosed by Yong. *Id.* ¶ 109 (citing Ex. 1009, 10).

Dr. Sims also identifies reasons why Choulis already achieves “the solution sought by Yong with its emitter concentration gradient.” *Id.* ¶ 110 (citing Ex. 1004 ¶¶ 56, 57 (Choulis’s reference to “a recombination zone through the emission layer” that ensures “[m]ore efficient use of the phosphorescent material’ and ‘extend[ing] the lifetime of the device”) (alterations in original).

In addition, Dr. Sims posits that Choulis’s architecture, which differs from Yong’s, uses “a specific amount of hole and electron injecting materials within the light emitting layer,” which, along with Choulis’s incorporation of “matching layers into the light emitting layer,” allows one to control and optimize “the cha[r]ge balance.” *Id.* ¶ 111.

iii. Analysis

Taking account of the information presented by both parties, we determine that the subject matter of claim 9 would have been obvious over Choulis in view of Yong. Pet. 48–51; Ex. 1044 ¶ 49. We agree with Petitioner that Patent Owner does not contest effectively, if at all, the

evidence that Yong discloses an emission layer having a gradient. Reply 18; *see* Resp. 49. Yong, moreover, “demonstrates the benefits of an emission layer with a gradient in an” organic light emitting device that is “similar to that disclosed by Choulis.” *Id.* (citing Ex. 1003 ¶¶ 160–166). Choulis and Yong “share the common objective of improving charge balance in the emissive layer.” *Id.* (citing Ex. 1004 ¶ 58; Ex. 1009, code (57) (Abstract)).

None of the differences raised by Patent Owner, as between the disclosures of Choulis and Yong, effectively undercuts Petitioner’s evidence that the combination of references would have suggested the invention of claim 9 to a person of ordinary skill in the art. *Compare* Resp. 48–49 and Sur-reply, *with* Pet. 48–50 *and* Reply 18–19. For example, although Yong discloses an evaporation process and Choulis discloses solution processing, Choulis additionally “discloses evaporation coating as a viable method” of application, and it was well-known in the art that PVK is amenable to application by the evaporation technique. Reply 19.

iv. Conclusion

We determine that Petitioner establishes by a preponderance of the evidence that the subject matter of claim 9 would have been obvious over the disclosures of Choulis and Yong.

F. Ground 4: Anticipation by Sugiura

Petitioner asserts that claims 1, 3, 5–8, and 10–13 are anticipated by Sugiura. Pet. 51. Petitioner provides a detailed claim chart mapping every limitation of these claims to disclosures in Sugiura. *Id.* at 52–68. We find this evidence persuasive of anticipation, notwithstanding Patent Owner’s counterarguments. Resp. 53–60.

We take account of Patent Owner’s view that Sugiura’s hole and electron transport materials do not qualify as matrix materials. Patent Owner’s argument, however, rests on an assertion that Sugiura’s materials are “dispersed agglomerations.” Resp. 54. For reasons provided above in our claim construction analysis, that is not a basis for determining that Sugiura’s materials fail to meet the challenged claims.

In any event, Petitioner comes forward with persuasive evidence that Sugiura’s materials are not dispersed agglomerations. Reply 20 (citing Ex. 1044 ¶ 59). On that point, Petitioner notes, Sugiura’s first, second, and third matrix materials “can be mixed in a ratio of 100:60:80:0.2.” *Id.* (citing Ex. 1006 ¶ 62); *see id.* n.10 (explaining that the ’164 patent explicitly identifies Sugiura’s third matrix material, Alq₃, “as another matrix material” (citing Ex. 1001, 8:3–9). Petitioner directs us to additional evidence, including cross-examination testimony of Patent Owner’s witness, Dr. Sims, supporting that Sugiura’s materials are not dispersed agglomerations. *Id.* at 20–22 (and evidence cited therein).

Nor are we persuaded that Sugiura fails to disclose the claimed HOMO and LUMO levels. Resp. 59–60. Petitioner persuasively disposes of that argument in a discussion of the evidence that we adopt as our own. Reply 22–23.

On this record, Petitioner shows by a preponderance of the evidence that Sugiura anticipates claims 1, 3, 5–8, and 10–13.

G. Ground 5: Obviousness Over Sugiura

Petitioner also challenges claims 1, 3, 5–8, and 10–13 as unpatentable based on obviousness over Sugiura. *See* Pet. 51–68. Reply 19–23.

We take account of Patent Owner’s arguments that Petitioner “ostensibly includes obviousness in view of Sugiura . . . but fails to propose any actual modification or reasoning” in support thereof. Resp. 53. We find that argument unpersuasive based on the particular arguments and evidence asserted by Petitioner. *See* Pet. 51–68; Reply 19–23.

Accordingly, based on our findings above that Sugiura anticipates claims 1, 3, 5–8, and 10–13, we determine that Sugiura likewise renders obvious the subject matter of those claims. *See Connell*, 722 F.2d at 1548 (“[A]nticipation is the epitome of obviousness.”).

H. Ground 6: Anticipation by Thompson

Petitioner directs us to persuasive evidence that Thompson anticipates claims 15 and 16, including detailed claim charts that map every limitation of the claims to disclosures in Thompson. Pet. 69–82.

Patent Owner opposes based on arguments that substantially correspond to those we have already considered and rejected elsewhere in this Decision. *See* Resp. 60–65. In addition, for reasons well-stated by Petitioner, we find Patent Owner’s arguments ineffective to undercut the sufficiency of this challenge. Reply 23–26.

On this record, Petitioner establishes by a preponderance of the evidence that claims 15 and 16 are anticipated by Thompson.

I. Ground 7: Obviousness Over Thompson

Petitioner also challenges claims 15 and 16 as unpatentable based on obviousness over Thompson. *See* Pet. 69–82. Petitioner includes detailed, persuasive claim charts that map every limitation of claims 15 and 16 to disclosures in Thompson. *Id.*

We take account of Patent Owner’s arguments that Petitioner “ostensibly includes obviousness” over Thompson, “but does not propose any actual modification to the teachings of the primary reference.” Resp. 60. As we did in connection with the obviousness ground based on Sugiura, however, we find Patent Owner’s argument unpersuasive based on the particular arguments and evidence asserted by Petitioner. *See* Pet. 69–82; Reply 23–26.

Accordingly, based on our findings above that Thompson anticipates claims 15 and 16, we determine that Thompson likewise renders obvious the subject matter of those claims. *See Connell*, 722 F.2d at 1548 (“[A]nticipation is the epitome of obviousness.”).

IV. CONCLUSION²³

For the foregoing reasons, we determine that Petitioner demonstrates by a preponderance of the evidence that claims 1–16 of the ’164 patent are unpatentable. Our conclusions are summarized in the following table.

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–8, 10–16	102(b)	Choulis	1–8, 10–13, 15, 16	14

²³ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–8, 10–16	103(a)	Choulis	1–8, 10–16	
9	103(a)	Choulis, Yong	9	
1, 3, 5–8, 10–13	102(b)	Sugiura	1, 3, 5–8, 10–13	
1, 3, 5–8, 10–13	103(a)	Sugiura	1, 3, 5–8, 10–13	
15–16	102(b)	Thompson	15–16	
15–16	103(a)	Thompson	15–16	
Overall Outcome			1–16	

V. ORDER

It is

ORDERED that Petitioner demonstrates by a preponderance of the evidence that claims 1–16 of the '164 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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Patent 8,723,164 B2

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